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JAN 3 2018

CENTRAL DISTRICT OF CALIFORNIA

BY: vdr DEPUTY

Louis A. Coffelt, Jr.  
 email: Louis.Coffelt@gmail.com  
 231 E. Alessandro Blvd., Ste 6A-504  
 Riverside, CA 92508  
 Phone: (951) 790-6086  
 Pro Se

**UNITED STATES DISTRICT COURT**

for the Central District of California

Case No.: **5:17-cv-01684-FMO-SHK**

**SECOND AMENDED COMPLAINT  
 FOR COPYRIGHT INFRINGEMENT**

**JURY TRIAL DEMAND****JURISDICTION**

1. This Court has subject matter jurisdiction pursuant to 17 U.S.C. §§ 101, et. seq., and 28 U.S.C. §§ 1331 and 1338(a) any Act of Congress relating to patents, copyrights, and trademarks.
2. This Court has personal jurisdiction over Defendant Autodesk, Inc. based on the allegation that Defendant committed and continues to commit acts of infringement in violation of 17 U.S.C. §§ 101, et. seq., and 17 U.S.C. § 501(a). Furthermore, based on the allegation that Autodesk, Inc. places infringing products into the stream of commerce, and Defendant has the knowledge or understanding that such products are sold in the State of California, including this Central District of California. Based on information and belief, Autodesk, Inc. has substantial revenue from the sale of infringing products within this District, expect their actions to have consequences in this District, and derive substantial revenue from the infringing products through interstate and international commerce.

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CLERK U.S. DISTRICT COURT  
CENTRAL DIST. OF CALIF.  
LOS ANGELES

Louis A. Coffelt, Jr.,

Plaintiff,

Autodesk, Inc.,

Defendant.

**VENUE**

3. Venue is proper within this District under 28 U.S.C. § 1391(b),(c) based on the allegation that Autodesk, Inc., transacts business in this District, and offers for sale in this District products which infringe Plaintiff's copyrights. Furthermore, venue is proper in this District based on the fact that Plaintiff resides in this District, and Plaintiff incurred injuries in this District. Pursuant to Local Rule 3-2(c), Intellectual Property Actions are assigned on a district-wide basis.

**PARTIES**

4. Plaintiff's name is Louis A. Coffelt, Jr. referred to herein as (Coffelt). Coffelt resides at 5300 Herrera Ct., Riverside, CA 92505.

5. A first Defendant is Autodesk, Inc. referred to herein as (Autodesk), having a Corporate office at 111 McInnis Parkway, San Rafael, CA 94903.

**INTRODUCTION**

6. Plaintiff, Coffelt is the author of Photorealistic computer aided design (CAD). Digital images now have the appearance of a photograph of real objects (photorealistic). For example, On August 21, while Coffelt is filing a document with the District Court Clerk, there is a total solar eclipse occurring in Piedmont Missouri, Silver Lake Missouri, St Louis Missouri, Farmington Missouri, and Perryville Missouri; and Coffelt's copyrighted work will derive a concise digital image of the corresponding shadow for any specific resolution implemented.

There are 3 distinct programs directed to Coffelt's Photorealistic results:

- (a) Vector Plane Intersection;
- (b) Surface Shading by Reflective Intensity;
- (c) Steradian Space for Light Occlusion Derivation.

Coffelt is the sole owner of all rights title and interest in Coffelt's programs. United States Certificates of Registration have been issued for Coffelt's Literary Works.

7. Coffelt applied more than 10,000 hours of work directed to development of Coffelt's CAD programs and support programs. These 10,000 hours of Coffelt's work occurred between the year 2010 through 2014. Coffelt created more than 50,000 digital files related to Coffelt's copyrighted works.



1 8. Photorealistic CAD programs do not exist prior to Coffelt's copyrighted works.

2 Photorealistic CAD images do not exist prior to Coffelt's copyrighted works.

3 9. Starting about the year 1970 through about 2010, ("ray tracing") is the foundation of CAD.  
4 More than 200 lines of source code is iterated millions of times in order to derive one pixel in a  
5 bitmap. For example, millions of rays are cast into a CAD scene, where only a few thousand rays  
6 will create a graphic object. Ray tracing is essentially a method to search for graphic objects. Ray  
7 tracing is well-known to be inaccurate.

8 10. Starting about the year 1970 through about 2010, all graphic surfaces in CAD are  
9 polygon approximations. For example, a specific set of flat polygons are used to approximate a  
10 spherical surface. Ray tracing is used to find an intersection with each polygon in order to  
11 create the image of the sphere. Realistic smooth curved surfaces do not exist in this 40 year period.

12 11. Starting about the year 1970 through about 2010, non-realistic surface shading is the state  
13 of the art for CAD. All surfaces in this period are polygon approximations. Surfaces are not realistic  
14 with polygon approximations. Therefore, realistic surface shading can not exist in the domain of  
15 polygon approximations.

16 12. Starting about the year 1970 through about 2010, 2 dimensional shadow maps  
17 is the state of art. For more than 40 years, CAD programs create only 2 dimensional shadows.  
18 For more than 40 years, 2 dimensional shadows is the expected result.

19 13. For more than 40 years, CAD programs required millions of CPU clock cycles in  
20 order to derive one pixel in a bitmap. In comparison, Coffelt's copyrighted work derives one pixel  
21 in only about 20 CPU clock cycles.

22 14. Autodesk is an American corporation which makes software for the architecture,  
23 engineering, construction, manufacturing, media, and entertainment industries.

24 15. For 35 consecutive years, between the year 1982 through about 2010, all Autodesk products  
25 use ray tracing.

26 16. For 35 consecutive years, between the year 1982 through about 2010, Autodesk's products  
27 use polygon surface approximations with ray tracing.

28 17. For 35 consecutive years, between the year 1982 through about 2010, Autodesk's products

1 create polygon surface shading approximations with ray tracing.

2 18. For 35 consecutive years, between the year 1982 through about 2010, Autodesk's products  
3 create 2 dimensional shadow approximations on polygon surface approximations with ray tracing.

4 19. For 35 consecutive years, between the year 1982 through about 2010, Autodesk's products  
5 create non-photorealistic digital images.

6 20. Sony Imageworks is making unauthorized derivative works of Coffelt's copyrighted  
7 works. Sony Imageworks makes and distributes a product titled Open Source Shading  
8 Language (OSL); also referred to as ("imageworks/OpenShadingLanguage") on public internet  
9 sites. Exhibits attached to this complaint show Sony Imageworks has derived their OSL source  
10 code from Coffelt's copyrighted works. OSL is Not a ("staple article or commodity of commerce  
11 suitable for substantial noninfringing use"). Surface shading created by OSL is identical to surface  
12 shading created by Coffelt's copyrighted works.

13 21. Sony Imageworks publications confirm that Autodesk's products are adapted to  
14 distribute the infringing OSL source code.

15 22. Autodesk publications confirm that Autodesk has adapted their products to distribute  
16 OSL. The unauthorized distribution of OSL by Sony Imageworks is direct copyright infringement.  
17 Therefore, Autodesk materially contributes to the direct copyright infringement of Coffelt's  
18 copyrighted works.

19 23. In April, 2017, Coffelt notified Autodesk of the alleged copyright infringement.  
20 These two components, substantial contribution, and knowledge of infringing activity, show  
21 Autodesk is liable for contributory infringement of Coffelt's copyrighted works.

22 24. In July, 2017, Coffelt notified all Autodesk executives of the alleged copyright  
23 infringement. All Autodesk executives have an explicit reason to know distribution of  
24 OSL is copyright infringement. Each Autodesk executive, as an individual, is inducing  
25 the copyright infringement of Coffelt's claimed works. These two components, inducing  
26 infringement, and knowledge of infringing activity, show each Autodesk executive, as an  
27 individual, is liable for contributory infringement of Coffelt's copyrighted works.

28 25. Autodesk has the right and ability to supervise and control the distribution of OSL.



1 Autodesk is the sole owner of all rights title and interest in their asserted software products.  
2 Furthermore, Autodesk's Software License Terms expressly provide that Autodesk may  
3 cancel any user's access to OSL at any time.

4 26. Autodesk obtains a direct benefit from the unauthorized distribution of OSL.  
5 Autodesk obtains this benefit through license fees for their software products. Autodesk  
6 also advertises the awesome photorealistic results created by their shaders, which is OSL.

7 27. These two components, right and ability to control, and direct benefit, show Autodesk has  
8 vicarious liability in the copyright infringement claims of this action.

9 28. Discovery in this action will show that Autodesk is either committing acts of  
10 direct copyright infringement, contributory infringement, or has vicarious liability, in  
11 regard to Coffelt's Vector Work.

12 29. Discovery in this action will show that Autodesk is either committing acts of  
13 direct copyright infringement, contributory infringement, or has vicarious liability, in  
14 regard to Coffelt's Steradian Work.

15 30. Coffelt's CAD Work comprises a combination of Coffelt's Vector Work,  
16 Coffelt's Gradient Work, and Coffelt's Steradian Work. Therefore, Discovery will show  
17 Autodesk is either committing acts of direct copyright infringement, contributory infringement,  
18 or has vicarious liability, in regard to Coffelt's CAD Work.

19 31. In April, 2017, Coffelt contacted Autodesk CEO Carl Bass, Pixar, and Nvidia,  
20 Corporation regarding the issue of photorealistic CAD. Coffelt requested each separately to explain  
21 how they are creating photorealistic digital images. Furthermore, Coffelt notified Autodesk, Pixar,  
22 and Nvidia of Coffelt's copyrighted computer programs. To this date, there has been no reply to  
23 Coffelt's request for information in regard to photorealistic CAD.

24 32. In June, 2017, Coffelt sent a Cease and Desist letter to Autodesk CEO, Carl Bass, in  
25 regard to the present copyright infringement issues.

26 33. In July, 2017, Coffelt sent a Cease and Desist letter to each executive officer and director  
27 of Autodesk in regard to the present copyright infringement issues.  
28

34. In February, 2013, Autodesk and Sony Imageworks has access to Coffelt's copyrighted work through Coffelt's U.S. patent No. 8,614,710 publication.

35. On 3 occurrence, first in the year 2010, second in the year 2011, and third in the year 2013, Autodesk attains access to Coffelt's copyrighted works by California Department of Corrections (CDC) agents. CDC agents have caused Coffelt's copyrighted works to be copied and distributed world wide without Coffelt's authorization.

36. Forty years of failed attempts, a dissection of Coffelt's solution, documents showing distribution, and identical results, is substantial evidence showing Defendant Autodesk is committing acts in violation of 17 U.S.C. § 501, is liable for contributory copyright infringement, or has vicarious liability, directed to Coffelt's copyrighted works.

37. The copyright infringement claims herein are not exhaustive. Coffelt will file additional copyright infringement actions against Autodesk and specific individuals.

#### STATEMENT OF FACTS

38. Plaintiff Coffelt is the sole owner of all rights title and interest in Federally Registered Copyrights of Coffelt's creative works. The following is a list of Coffelt's registered copyrights, including and not limited to: *(all Exhibits are in the attached Appendix)*

#### Coffelt's Copyrighted Works

39. On December 14, 2017, Coffelt filed an application for United States copyright for Coffelt's work titled "Vector Plane Intersection" Registration No. TXu002035517 registration date: December 14, 2016 (Vector Work) *See* EXHIBIT 100. Coffelt's Vector Work source code is attached in EXHIBIT 100. Coffelt's Vector Work was created in the year 2010.

40. On May 13, 2017, Coffelt filed an application for United States copyright for Coffelt's work titled "Realistic 3D Surface Shading by Reflective Intensity 2010" case number 1-5121154211 (Gradient Work 2010) *See* EXHIBIT 101. Coffelt's Gradient Work 2010 source code is attached in EXHIBIT 101. Coffelt's Gradient Work 2010 was created in the year 2010.

41. On June 12, 2017, Coffelt filed an application for United States copyright for Coffelt's work titled "Photorealistic Surface Shading by Reflective Intensity 2017" U.S. registration No. TX0008447381 (Photorealistic Gradient Work) *See* Coffelt's source code in EXHIBIT 102.





1 Coffelt's Photorealistic Gradient Work was created in the year 2013; and is a derivative work  
2 of Coffelt's Gradient Work 2010. Coffelt's Photorealistic Gradient Work appears in Coffelt's  
3 Gradient Work.

4 42. On December 13, 2016, Coffelt filed an application for United States copyright for  
5 Coffelt's work titled "CAD Reflective Intensity" Registration No. TXu002049564 registration  
6 date: December 13, 2016 (Gradient Work) *See* EXHIBIT 103. Coffelt's Gradient Work source  
7 code is attached in EXHIBIT 103. Coffelt's Gradient Work was created in the year 2013; and is  
8 a derivative work of Coffelt's Gradient Work 2010.

9 43. On December 15, 2016, Coffelt filed an application for United States copyright for  
10 Coffelt's work titled "Steradian Space For Light Occlusion Derivation" Registration No.  
11 TX0008356641 registration date: December 15, 2016 (Steradian Work) *See* EXHIBIT 104.  
12 Coffelt's Steradian Work source code is attached in EXHIBIT 104. Coffelt's Steradian Work was  
13 created in the year 2010.

14 44. On December 28, 2016, Coffelt filed an application for United States copyright for  
15 Coffelt's work titled "emoshaGraphics CAD alpha" registration No. TXu002037997 registration  
16 date: December 28, 2016 (CAD Work Alpha) *See* EXHIBIT 105. Coffelt's CAD Work Alpha  
17 comprises a combination of Coffelt's Vector Work, Coffelt's Gradient Work, and Coffelt's  
18 Steradian Work. The first 3 pages of Coffelt's CAD Work Alpha is attached in EXHIBIT 105.

19 45. On January 13, 2017, Coffelt filed an application for United States copyright for Coffelt's  
20 work titled "emoshaGraphics CAD" Registration No. TX0008400276 registration date: January 13,  
21 2017 (CAD Work) *See* EXHIBIT 106. Coffelt's CAD Work comprises a combination of Coffelt's  
22 Vector Work, Coffelt's Gradient Work, and Coffelt's Steradian Work. The first 3 pages of Coffelt's  
23 CAD Work is attached in EXHIBIT 106.

#### 24 **Coffelt's Particular Results**

25 46. Coffelt's Vector Work is a Literary Work; comprising a computer program creating  
26 particular results comprising:

27 (a) On Saturday, November 16, 2013, a specific distinct set of bytes in Coffelt's computer  
28 which correspond to a specific distinct cylinder graphic object, having graphical photorealistic

1 resolution in a CAD scene *See* EXHIBIT 107;

2 (b) On Thursday, November 14, 2013, a specific distinct set of bytes in Coffelt's computer  
3 which correspond to a specific distinct sphere graphic object, having graphical photorealistic resolution  
4 in a CAD scene *See* EXHIBIT 108;

5 (c) On Friday, September 20, 2013, a specific distinct set of bytes in Coffelt's computer  
6 which correspond to a specific distinct plane graphic object, having graphical photorealistic resolution  
7 in a CAD scene *See* EXHIBIT 109;

8 (d) On Saturday, November 16, a specific photorealistic image of the cylinder graphical object  
9 on Coffelt's computer monitor *See* EXHIBIT 107;

10 (e) On Thursday, November 14, 2013, a specific photorealistic image of the sphere graphical  
11 object on Coffelt's computer monitor *See* EXHIBIT 108;

12 (f) On On Friday, September 20, 2013, a specific photorealistic image of the plane graphical  
13 object on Coffelt's computer monitor *See* EXHIBIT 109;

14 (g) A photorealistic image of the cylinder on paper *See* EXHIBIT 107;

15 (h) A photorealistic image of the sphere on paper *See* EXHIBIT 108;

16 (i) A photorealistic image of the plane on paper *See* EXHIBIT 109.

17 47. Coffelt's Steradian Work is a Literary Work; comprising a computer program creating  
18 particular results comprising:

19 (a) On Saturday, November 16, 2013 a specific distinct set of bytes in Coffelt's computer  
20 which correspond to specific distinct shadows cast onto a cylinder graphic object, having  
21 photorealistic resolution, in a CAD scene *See* EXHIBIT 107;

22 (b) On Thursday, November 14, 2013, a specific distinct set of bytes in Coffelt's computer,  
23 which correspond to specific distinct shadows cast onto a sphere graphic object, having graphical  
24 photorealistic resolution, in a CAD scene *See* EXHIBIT 108;

25 (c) On Friday, September 20, 2013, a specific distinct set of bytes in Coffelt's computer  
26 which correspond to specific distinct shadows cast onto a plane graphic object, having graphical  
27 photorealistic resolution, in a CAD scene *See* EXHIBIT 109;

28 (d) On Saturday, November 16, 2013, specific photorealistic shadows cast onto the cylinder



1 graphical object on Coffelt's computer monitor *See* EXHIBIT 107;

2 (e) On Thursday, November 14, 2013, specific photorealistic shadows cast onto the sphere  
3 graphical object on Coffelt's computer monitor *See* EXHIBIT 108;

4 (f) On On Friday, September 20, 2013, specific photorealistic shadows cast onto the  
5 plane graphical object on Coffelt's computer monitor *See* EXHIBIT 109;

6 (g) Photorealistic shadows cast onto the cylinder on paper *See* EXHIBIT 107;

7 (h) Photorealistic shadows cast onto the sphere on paper *See* EXHIBIT 108;

8 (i) Photorealistic shadows cast onto the plane on paper *See* EXHIBIT 109.

9 48. Coffelt's Gradient Work is a Literary Work; comprising a computer program creating  
10 particular results comprising:

11 (a) On Saturday, November 16, 2013 a specific distinct set of bytes in Coffelt's computer which  
12 correspond to specific distinct gradient on a cylinder graphic object, having photorealistic  
13 resolution, in a CAD scene *See* EXHIBIT 107;

14 (b) On Thursday, November 14, 2013, a specific distinct set of bytes in Coffelt's computer,  
15 which correspond to specific distinct gradient on a sphere graphic object, having graphical  
16 photorealistic resolution, in a CAD scene *See* EXHIBIT 108;

17 (c) On Friday, September 20, 2013, a specific distinct set of bytes in Coffelt's computer  
18 which correspond to specific distinct gradient on a plane graphic object, having graphical  
19 photorealistic resolution, in a CAD scene *See* EXHIBIT 109;

20 (d) On Saturday, November 16, 2013, a specific photorealistic image of the cylinder graphical  
21 object on Coffelt's computer monitor *See* EXHIBIT 107;

22 (e) On Thursday, November 14, 2013, specific photorealistic surface gradient on the sphere  
23 graphical object on Coffelt's computer monitor *See* EXHIBIT 108;

24 (f) On On Friday, September 20, 2013, specific photorealistic shadows cast onto the  
25 plane graphical object on Coffelt's computer monitor *See* EXHIBIT 109;

26 (g) Photorealistic shadows cast onto the cylinder on paper *See* EXHIBIT 107;

27 (h) Photorealistic shadows cast onto the sphere on paper *See* EXHIBIT 108;

28 (i) Photorealistic shadows cast onto the plane on paper *See* EXHIBIT 109.

49. Coffelt's CAD Work is a Literary Work; comprising the Vector Work, Gradient Work, Photorealistic Gradient Work, and Steradian Work having particular result comprising publications on the well known website YouTube, and having a title:

(a) SteelBallsX

<https://www.youtube.com/watch?v=UJWXeHVvJu0>

published November 27, 2013;

(b) emoshaGraphics (TM) CAD demo Jan 24, 2017

<https://www.youtube.com/watch?v=Qfm-vxMeRMI&t=2s>

published January 24, 2017.

#### **The Foundation of Coffelt's Photorealistic CAD**

50. Coffelt's Vector Work is a foundation of Photorealistic CAD. *See* EXHIBIT 100. A specific location of one pixel in a bitmap is derived by only about 10 lines of source code iterated only one time. e.g. a specific pixel row, and pixel column is derived. Vector Plane Intersection is disclosed in Coffelt's U.S. patent No. 8,614,710 (710 patent) *See* EXHIBIT 110. A search of USPTO.gov and Copyright.gov database shows Coffelt is the sole person, which discloses a concise method for vector plane intersection. Coffelt's Vector Work provides that CAD surfaces can be derived at ANY desired resolution, with 100 percent accuracy.

#### **The Foundation of CAD 1970 through 2010**

51. For more than 40 years, from about 1970 through about 2010, Computer Aided Design is based on the well-known method of "ray tracing". More than 200 lines of computer code is iterated millions of times in order to derive one pixel color in a bitmap image.

52. In the early years of CAD, server farms were developed containing thousands of servers in order to create one frame of a complex graphic scene. The improvement of computer processors eliminated the need for these server farms. However, the fundamental structure of ray tracing remains unchanged to this date. The core structure of ray tracing includes the following:

(a) utilize a particular set of pixels on a view plane (image plane) e.g. a set of pixels for a

1920 x 1080 bitmap is equal to 1920 pixel width \* 1080 pixel height = 2073600 pixels;



- (b) utilize a particular method to select the start location of a ray;
- (c) incrementing the ray into the graphic object scene;
- (d) at each ray increment, test for an intersection with each and every possible point of graphic objects (e.g. millions of graphic object points are possible).

53. Ray tracing uses flat polygons to approximate a real curved surface.

54. There are at least 380 United States Patents directed to methods for ray tracing. From 1970 through present, the core structure of ray tracing, identified above at items (a) through (d) in paragraph 52, has remain unchanged. The following patents are the results of a search of USPTO.gov patent collection data base search for the terms:

ccl/345/422 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/424 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/426 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/427 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/428 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/441 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/442 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/581 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/586 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/589 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/591 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/593 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/622 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/632 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/633 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/634 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")  
 ccl/345/653 and (ttl/"ray tracing" or spec/"ray tracing" or ttl/"raytracing" or spec/"raytracing")

55. There are 380 U.S. patents directed to improvements in ray tracing. For example, determine specific locations to position a ray; super sampling; using specific probability

formulas; hierarchy; and secondary rays, including others.

56. The following 380 U.S. patents are directed to ray tracing, and improvements to ray tracing; and each one of these 380 U.S. patents is incorporated herein by reference

(Incorporated Patents):

9,035,945	9,024,972	9,007,388	8,988,465	8,988,449	8,988,433	8,976,199	8,970,626
8,970,592	8,970,591	8,963,918	8,952,977	8,952,961	8,933,967	8,928,658	8,907,950
8,878,873	8,872,824	8,860,733	8,860,712	8,854,369	8,854,367	8,836,702	8,823,708
8,817,014	8,797,324	8,797,322	8,791,951	8,773,422	8,760,450	8,749,552	8,736,610
8,717,366	8,698,806	8,692,828	8,675,022	8,665,271	8,659,591	8,638,332	8,629,881
8,619,094	8,619,079	8,619,078	8,593,459	8,587,588	8,581,926	8,570,322	8,564,589
8,553,028	8,547,374	8,542,231	8,520,021	8,502,819	8,493,383	8,482,561	8,466,919
8,441,482	8,436,852	8,421,821	8,421,801	8,417,261	8,411,088	8,390,618	8,379,030
8,379,026	8,379,022	8,373,715	8,373,699	8,368,694	8,363,053	8,358,305	8,355,019
8,350,846	8,339,398	8,319,825	8,310,481	8,300,049	8,284,195	8,275,397	8,274,530
8,269,770	8,259,105	8,259,101	8,253,753	8,248,416	8,248,415	8,248,412	8,248,405
8,248,401	8,243,073	8,237,730	8,237,711	8,218,903	8,217,931	8,212,816	8,212,806
8,207,968	8,203,559	8,189,006	8,189,003	8,189,001	8,188,997	8,188,996	8,179,566
8,164,590	8,160,391	8,159,499	8,159,492	8,139,060	8,134,556	8,134,551	8,130,244
8,120,991	8,120,609	8,115,763	8,106,921	8,106,906	8,102,391	8,089,481	8,085,267
8,081,185	8,077,183	8,072,454	8,063,902	8,049,752	8,035,641	8,031,210	8,031,191
8,026,915	8,018,457	8,013,857	8,009,176	7,991,240	7,983,788	7,978,192	7,973,790
7,969,433	7,952,583	7,952,574	7,940,266	7,932,913	7,932,905	7,924,295	7,903,113
7,884,819	7,880,743	7,864,187	7,864,174	7,852,336	7,830,379	7,808,501	7,808,500
7,796,128	7,791,602	7,773,087	7,768,524	7,755,628	7,755,627	7,737,974	7,737,970
7,719,544	7,719,532	7,710,431	7,692,647	7,688,320	7,652,666	7,619,626	7,609,264
7,593,019	7,589,729	7,586,489	7,573,475	7,554,540	7,548,238	7,542,044	7,525,543
7,515,152	7,499,053	7,495,664	7,479,962	7,479,960	7,471,301	7,456,837	7,446,777
7,439,973	7,432,935	7,427,996	7,414,624	7,379,060	7,358,971	7,345,687	7,324,116



1	7,321,370	7,310,098	7,289,119	7,286,971	7,268,789	7,256,782	7,250,948	7,246,045
2	7,245,301	7,233,337	7,230,624	7,230,623	7,227,555	7,218,322	7,212,207	7,199,795
3	7,196,704	7,184,042	7,173,622	7,170,510	7,167,177	7,154,504	7,148,891	7,136,790
4	7,133,044	7,133,041	7,129,944	7,129,942	7,126,605	7,123,259	7,113,184	7,106,325
5	7,102,636	7,098,915	7,084,871	7,079,157	7,079,139	7,071,938	7,071,936	7,050,054
6	7,050,053	7,047,014	7,046,243	7,034,825	7,034,818	7,027,046	7,012,615	7,012,604
7	7,002,589	7,002,570	6,999,096	6,989,832	6,985,240	6,983,082	6,982,714	6,979,084
8	6,972,758	6,961,058	6,956,570	6,943,805	6,943,789	6,940,529	6,940,508	6,933,939
9	6,924,816	6,922,193	6,919,909	6,909,436	6,864,890	6,828,978	6,825,851	6,798,409
10	6,791,567	6,788,304	6,784,882	6,781,598	6,771,272	6,753,878	6,731,304	6,731,284
11	6,724,393	6,724,384	6,704,017	6,697,062	6,646,640	6,639,597	6,628,298	6,597,359
12	6,583,787	6,570,578	6,567,083	6,556,200	6,515,664	6,512,995	6,496,597	6,466,227
13	6,466,207	6,437,796	6,434,278	6,429,864	6,421,050	6,414,684	6,414,681	6,400,365
14	6,400,364	6,373,485	6,369,818	6,359,629	6,348,919	6,342,889	6,329,989	6,329,988
15	6,324,347	6,323,863	6,307,568	6,300,965	6,285,376	6,268,863	6,226,005	6,222,937
16	6,157,387	6,157,385	6,128,021	6,111,582	6,097,854	6,097,394	6,064,393	6,061,065
17	6,044,181	6,034,691	6,016,150	6,009,190	5,987,164	5,986,668	5,966,134	5,966,131
18	5,940,067	5,936,630	5,933,146	5,903,274	5,823,780	5,821,942	5,809,219	5,796,407
19	5,742,796	5,742,293	5,729,672	5,717,848	5,715,384	5,687,307	5,684,937	5,673,376
20	5,638,499	5,602,979	5,594,854	5,594,850	5,594,844	5,588,098	5,583,975	5,566,283
21	5,553,214	5,550,959	5,548,693	5,528,741	5,528,737	5,526,471	5,488,700	5,384,901
22	5,384,899	5,371,778	5,355,442	5,313,568	5,305,430	5,299,298	5,297,043	5,283,859
23	5,257,355	5,239,624	5,138,699	5,058,042	5,038,302	5,031,117	5,025,400	4,987,554
24	4,928,250	4,865,423	4,807,158	4,645,459				
25								
26								
27								
28								

**CAD Surface Gradients 1970 through 2010**

57. For more than 40 years, starting in about the year 1970 through about 2010, CAD programs used ray tracing and a series of flat polygons to approximate curved surfaces. (polygon approximation). For example, polygon approximation uses a specific quantity of triangular surface area to define one portion of a curved surface. Polygon approximation does not create realistic surfaces. Polygon approximation is inherently described in the Incorporated Patents.

58. Vector Plane intersection equations do not exist prior to Coffelt's Vector Work. These Incorporated Patents are a basis. Prior CAD explicitly use ray tracing.

59. Polygon approximation curved surfaces are not realistic. Therefore, realistic surface gradients can not exist on these curved surface approximations. For more than 40 years, starting in about the year 1970 through about 2010, all CAD surface gradients are non-realistic approximations. *See* EXHIBIT 111. The AutoCAD drawing in EXHIBIT 111 is exemplary of all prior CAD non-realistic surface shading; source title:

("AutoCAD 2009 and AutoCAD LT 2009: No Experience Required") By Jon McFarland  
Internet search results are replete with monotone surfaces allegedly created by AutoCAD 2009.

60. Pixar results in EXHIBIT 112 through EXHIBIT 119 show evidence of State of the Art of CAD. EXHIBIT 112 through EXHIBIT 119 show photorealistic CAD images begin about the year 2013.

61. Polygon approximation surfaces are not realistic. Therefore, realistic shadows can not exist on these surface approximations. For more than 40 years, starting in about the year 1970 through about 2010, all CAD shadows are non-realistic approximations. *See* United States District Court, for the Central District of California, case No. ED CV16-00457 Coffelt v Nvidia, Doc. No. 38, Doc. No. 41 which is incorporated herein by reference; *See* United States Court of Appeals for the Federal Circuit case No. 17-1119 Doc. 2, Filed: 11/08/2016 which is incorporated herein by reference; *See* United States Court of Appeals for the Federal Circuit, Coffelt v. Nvidia, case No. 17-1119 Doc. 21, 22 which is incorporated herein by reference.



### Coffelt's Photorealistic CAD Surface Gradients

62. Coffelt's CAD Work creates results which are significantly distinct from all prior CAD results. Coffelt's CAD Work uses Coffelt's Vector Work. Coffelt's Vector Work creates photorealistic surfaces. See EXHIBIT 107, EXHIBIT 108, EXHIBIT 109. Coffelt's CAD Work creates photorealistic images

63. Coffelt's Gradient Work is explained in EXHIBIT 120. In EXHIBIT 120, page 1, shows: a graphic surface (S); a reflection vector (rfla); a reflection vector (rflb); a view point VP; a light source point SP; a maximum distance to the View Point (d0a); a minimum distance to the View Point d0b; and a surface normal N. EXHIBIT 120 shows a core component of Coffelt's Gradient Work which is the surface gradient is based on the angle between the reflection vector and the direction of view. There are 2 directions of view in EXHIBIT 120, view vector (vpa), and view vector (vpb). There are 2 angles in EXHIBIT 120 used to derive the photorealistic gradient. Angle (a) is the angle between vector (rfla) and vector (vpa); (a) is the maximum angle for all reflection vectors on surface (S). Angle (b) is the angle between vector (rflb) and vector (vpb); (b) is the minimum angle for all reflection vectors on surface (S).

64. EXHIBIT 120, page 2, shows a linear equation used to derive the photorealistic surface gradient. The quantity of color shift is derived by the linear equation shown in EXHIBIT 120 page 2. In this example, (-50) is the maximum color shift, and zero is the minimum color shift. The maximum color shift occurs at (maxd); and the minimum shift occurs at (mind). The point slope equation is derived from the given values of : (-50), (mind), and (maxd). During runtime of Coffelt's Gradient Work, many various angles will be derived between the view direction and the reflection vector. The quantity of color shift is derived by this linear equation for each distinct d0 ( or cosine of the angle), or other equivalent parameter.

65. The foregoing paragraphs 63 and 64 is a technical description of the foundation of Coffelt's Gradient Work, and Photorealistic Gradient Work; and the corresponding source code is shown in the following paragraph 66.

### Coffelt's Foundation of Photorealistic Gradients

66. The foundation of Coffelt's Gradient Work, and Photorealistic Gradient Work is shown in Coffelt's source code in lines 0000 through 0014 as follows (TXu002049564 EXHIBIT 102):

```

0000  rflx = rptx - ptx00a;                (A)
0001  rfly = rpty - pty00a;                (A)
0002  rflz = rptz - ptz00a;                (A)
0003  lenrfl = sqrt(rflx * rflx + rfly * rfly + rflz * rflz);    (B)
0004  vpdotrfl = (vpax * rflx + vpay * rfly + vpaz * rflz) / (lenvpa * lenrfl);    (B)
0005  theta = acos(vpdotrfl);              (C)
0006  mgrad = -50 / (max_d - min_d);        (D) (E) (F)
0007  d0 = lenvpa * sin(theta);             (G)
0008  shiftD = mgrad * (d0 - min_d);        (H)
0009  blueD = 100.0;                       (I)
0010  greenD = 255.0;                      (I)
0011  redD = 100.0;                       (I)
0012  blueD += shiftD;                     (J)
0013  greenD += shiftD;                    (J)
0014  redD += shiftD;                      (J)

```

67. Larry Gritz dissects the foregoing Coffelt's source code, lines 0000 through 0014, and distributes it into various files in order to hide copyright infringement. Therefore, the above item reference (A) through (J) are used to identify the corresponding location of infringing OSL source code in EXHIBIT 121.

68. OSL source code is available for download to the public at the following url:  
<https://github.com/imageworks/OpenShadingLanguage> See EXHIBIT 122.

69. On Tuesday, August 01, 2017, 6:16:42 PM, Coffelt downloaded a copy of OSL source code from: <https://github.com/imageworks/OpenShadingLanguage> (OSL Infringing Code). The OSL Infringing Code is shown in EXHIBIT 121.



### Open Source Shading Language Copyright Infringement

70. Sony Pictures Imageworks, having an office address at 9050 W. Washington Blvd. Culver City, CA 90232 (Sony Imageworks) makes the product OSL source code.

71. The OSL source code in EXHIBIT 121 is identical to Coffelt's Gradient Work, or is a derivative of Coffelt's Gradient Work *See* EXHIBIT 121. For these reasons shown in EXHIBIT 121, OSL is an unauthorized derivative of Coffelt's Gradient Work. For these reasons, Sony Imageworks have infringed Coffelt's copyright in the identified OSL Products, in violation of Section 501 of the Copyright Act, 17 U.S.C. § 501(a).

72. The OSL source code in EXHIBIT 121 is identical to Coffelt's Gradient Work, or is a derivative of Coffelt's Gradient Work *See* EXHIBIT 121. Sony Imageworks distributes this infringing OSL source code at website: <https://github.com/imageworks/OpenShadingLanguage> *See* EXHIBIT 122. For these reasons, Sony Imageworks is, without authorization, distributing this infringing OSL source code. For these reasons, Sony Imageworks have infringed Coffelt's copyright in the identified OSL Products, in violation of Section 501 of the Copyright Act, 17 U.S.C. § 501(a).

### Larry Gritz, Open Source Shading Language

73. Open Source Shading Language (OSL) by Sony Imageworks and Larry Gritz (Gritz) is allegedly a new programming language. *See* EXHIBIT 127. A review of OSL source code shows OSL is merely a C++ language Application Program Interface (API) *See* EXHIBIT 121. A unique variable name "closure" is purportedly the basis for OSL being a new language. Gritz confirms that OSL is Not a new language by his allegation: ("it is simply a more convenient notation for describing shading") *See* EXHIBIT 127.

source: <http://blenderdiplom.com/en/interviews/531-interview-larry-gritz-lead-developer-of-osl.html>  
date EXHIBIT 127 downloaded: November 23, 2017.

74. Gritz does not provided any technical explanation of how OSL is a new language. Gritz only discloses that a "closure" is new, without any technical explanation of the physical structure of a "closure". *See* EXHIBIT 127.

75. Gritz explains that the programing language C is "clunky", and is the cause for the

1 necessity for a new programming language. Gritz does not explain the meaning of “clunky”; and  
 2 does not explain how he has overcome the problem of “clunky”. Gritz merely explains the  
 3 awesome results of his allegedly new programming language. *See* EXHIBIT 127.

4 76. Gritz also explains that it is optimal for Sony Imageworks to give away valuable  
 5 software free, rather than keep it to themselves. *See* EXHIBIT 127.

6 77. Larry Gritz is awarded a technical achievement award for OSL, without any  
 7 any explanation of his technical achievement. Larry Gritz receives an Academy Award for only  
 8 the photorealistic results. *See* EXHIBIT 128, and EXHIBIT 129.

9 78. Blender publications confirm that OSL is based on Coffelt’s Gradient Work.  
 10 Source: <https://docs.blender.org/manual/es/dev/render/cycles/nodes/types/input/fresnel.html>  
 11 date: August 13, 2017 *See* EXHIBIT 123. In EXHIBIT 123, the Blender publication alleges  
 12 that the photorealistic surface gradient is based on the direction of view, and the reflection vector.

13 79. A BusinessWire publication confirms that OSL is used in Autodesk Beast.  
 14 Source: [http://www.businesswire.com/news/home/20130325005005/en/Autodesk-Reveals-New-](http://www.businesswire.com/news/home/20130325005005/en/Autodesk-Reveals-New-Gameware-Advancements-GDC-2013)  
 15 Gameware-Advancements-GDC-2013 date: November 23, 2017 *See* EXHIBIT 130.

16 80. A Sony Imageworks publication confirms that OSL is used in Autodesk Beast.  
 17 Source: <http://opensource.imageworks.com/> date: August 16, 2017 *See* EXHIBIT 131.

#### 18 **Autodesk, Inc.**

19 81. Autodesk has adapted their products AutoCad, Fusion 360, Maya, InfraWorks,  
 20 AutoCAD Civil 3D, Revit, Inventor, or Beast (Autodesk Products), to materially contribute  
 21 to acts of copyright infringement of Coffelt’s copyrighted works.

22 82. Autodesk publication confirms that Autodesk has made unauthorized copies of  
 23 Coffelt’s copyrighted works. *See* EXHIBIT 134; Source:

24 [http://help.autodesk.com/view/BEAST/2015/ENU/?guid=\\_\\_files\\_](http://help.autodesk.com/view/BEAST/2015/ENU/?guid=__files_)

25 GUID\_B812FA2F\_A188\_4D9A\_A5A8\_ACD7A771AA89\_hm

26 date: November 23, 2017 (Autodesk OSL Publication).

27 83. The Autodesk OSL Publication shows Autodesk has adapted their product Maya or  
 28 Beast to download OSL source code identified in EXHIBIT 121:



1 (“These attributes are used to set up the BeastOSL node in Maya.”) *See* EXHIBIT 134 at page 4.

2 Furthermore, the Autodesk OSL Document directs a person to the url:

3 <https://github.com/imageworks/OpenShadingLanguage> (Infringing URL)

4 *See* EXHIBIT 134 at page 1.

5 84. This Infringing URL published in the Autodesk OSL Document confirms that  
6 Autodesk has adapted Beast or Maya to download the OSL source code shown in EXHIBIT 121.  
7 EXHIBIT 121 at page 1 shows the Infringing URL.

8 85. The Autodesk OSL Publication also shows Autodesk’s Application Program  
9 Interface (Autodesk’s OSL API) for OSL. *See* EXHIBIT 134 at pages 2, 3.

10 86. Autodesk publication confirms that Autodesk has adapted their product Beast to  
11 download the asserted OSL source code; publication title: (“What’s New in Beast 2013.2.x”); Source:  
12 [https://knowledge.autodesk.com/search-result/caas/CloudHelp/cloudhelp/2015/ENU/  
13 Beast-SDK-Help/files/GUID-08210E19-206D-4643-96EE-24DFDEE68845-htm.html](https://knowledge.autodesk.com/search-result/caas/CloudHelp/cloudhelp/2015/ENU/Beast-SDK-Help/files/GUID-08210E19-206D-4643-96EE-24DFDEE68845-htm.html)  
14 date: November 23, 2017 *See* EXHIBIT 132.

15 87. Autodesk publication confirms that Autodesk has adapted their product Beast to  
16 download the asserted OSL source code; publication title: (“New Feature: Open Shading  
17 Language Support”); Source:  
18 <https://forums.autodesk.com/t5/beast/new-feature-open-shading-language-support/td-p/4285745>  
19 date: August 11, 2017 *See* EXHIBIT 133.

20 88. Autodesk product Maya or Beast software is purchased by a person (User).  
21 During operation of Maya or Beast software by the User, the User’s computer is required  
22 to download a copy of OSL source code in order to execute a shading function:  
23 (“These attributes are used to set up the BeastOSL node in Maya.”) *See* EXHIBIT 134 page 4.  
24 Autodesk has specifically adapted Maya or Beast to execute this User’s download of OSL.  
25 Therefore, this User’s computer is required to execute a distribution of OSL source code.

26 89. A standard software development procedure is to compile and test the source code  
27 of the project. This test is typically used to make corrections to the software, and is commonly  
28 referred to as fixing bugs. The test are used to ensure the software produce the intended results.

1           90. For the reasons in paragraphs 82 through 89 inclusive, Autodesk has executed a  
2 test of the Autodesk OSL API. For the reasons in paragraphs 82 through 89 inclusive, Autodesk  
3 executed a test of Autodesk's Maya, and executed a test of Beast.

4           91. OSL is Not a staple article or commodity of commerce suitable for substantial  
5 noninfringing use. Autodesk publications and Sony Imageworks publications in this complaint  
6 are replete with evidence that the sole purpose of OSL is a shader function in CAD software. OSL  
7 is not stand alone software. e.g. OSL does not create the physical structure of a graphic object.  
8 OSL only creates the color of the graphic object. OSL must be used with other CAD software.

9           92. For the reasons in paragraphs 70 through 72; 82 through 91, Autodesk has  
10 downloaded and created an unauthorized copy of OSL in order to complete testing of the  
11 Autodesk OSL API, Maya, or Beast.

12           93. For the reasons in paragraphs 70 through 72; 82 through 92 Autodesk has made  
13 unauthorized copies of Coffelt's copyrighted Gradient Work, TXu002049564, or Photorealistic  
14 Gradient Work, U.S. registration No. TX0008447381.

15           94. For the reasons in paragraphs 70 through 72; 82 through 93, Autodesk materially  
16 contributes to the unauthorized distribution of Coffelt's copyrighted Gradient Work, registration No.  
17 TXu002049564, or Photorealistic Gradient Work, U.S. registration No. TX0008447381.

18           95. In April, 2017, Coffelt notified Autodesk of the alleged copyright infringement.

19           96. There are many reasons Autodesk had reason to know OSL is directed to  
20 copyright infringement, including, not limited to:

- 21           (a) Coffelt's notice to Autodesk of the alleged copyright infringement in April, 2017;
- 22           (b) 40 years of failed attempts by all others to create photorealistic digital images;
- 23           (c) Autodesk's 35 years of failed attempts to create photorealistic digital images;
- 24           (d) The numerous failed attempts to create photorealistic digital images,  
25           e.g. including the 380 Incorporated Patents;
- 26           (e) Autodesk is one of about only 3 worldwide major CAD software developers;
- 27           (f) Coffelt is the sole individual claiming intellectual property directed to photorealistic CAD.  
          e.g Coffelt is the sole author of Vector Plane Intersection; and complex 3D shadows



1           97. One who knowingly induces, causes, or materially contributes to copyright  
2 infringement, by another but who has not committed or participated in the infringing acts  
3 himself may be held liable as a contributory infringer if he or she had knowledge, or reason  
4 to know, of the infringement. See *Metro-Goldwyn-Mayer Studios Inc. v Gorkster, Ltd.*  
5 545 U.S. 913 (2005); *Sony Corp. v Universal City Studios, Inc.* 464 U.S. 417 (1984).

6           98. For the reasons in paragraphs 70 through 72; 82 through 97, Autodesk is committing  
7 acts of contributory infringement of Coffelt's copyrighted Gradient Work, registration No.  
8 TXu002049564, or Photorealistic Gradient Work, U.S. registration No. TX0008447381.

9           99. Autodesk is the sole owner of all rights title and interest in their CAD software  
10 products, including Beast and Maya. Autodesk makes the asserted software products Beast  
11 and Maya. Autodesk has the right and ability to remove source code from Beast and Maya,  
12 which provides access to OSL. Autodesk has both the right an ability to stop Maya and  
13 Beast from causing any infringing activity. Therefore, Autodesk has the right and ability to  
14 supervise the infringing activity identified in paragraphs 70 through 73 inclusive, and paragraphs 82  
15 through 96 inclusive.

16           100. Autodesk offers a license for their product Maya on the public internet for \$1470.00  
17 per year. See EXHIBIT 135.

18 Source: <https://www.autodesk.com/products/maya/overview>      date: November 26, 2017.

19           101. Autodesk has received financial benefit from the license of Maya or Beast.

20           102. When the right and ability to supervise coalesce with an obvious and direct  
21 financial interest in the exploitation of copyrighted materials. The purposes of copyright  
22 law may be best effectuated by the imposition of liability upon the beneficiary of that  
23 exploitation. See *Shapiro, Bernstein & Co. v H.L. Green Co.* 316 F.2d 304, 307 (2d Cir. 1963).

24           103. For the reasons in paragraphs 70 through 72; 82 through 91; 99 through 102,  
25 Autodesk has vicarious liability in this action directed to Coffelt's copyrighted Gradient Work,  
26 registration No. TXu002049564, or Photorealistic Gradient Work, U.S. registration No.  
27 TX0008447381.  
28

### OSL Results

104. OSL creates photorealistic surfaces in CAD. OSL creates results identical to Coffelt's CAD Work results. A comparison in EXHIBIT 136 shows Autodesk's surface shading is identical to Coffelt's surface shading on the cylinder. Autodesk uses OSL to create the surface shading on the cylinder. Coffelt uses Coffelt's Vector Work, Gradient Work, and CAD Work to create the surface shading on the cylinder. EXHIBIT 137 through EXHIBIT 141 show additional examples that OSL results are identical to Coffelt's results.

### Autodesk Access To Coffelt's Copyrighted Work

105. Autodesk attained access to Coffelt's copyrighted works on February 28, 2013 by Coffelt's U.S patent No. 8,614,710 publication.

106. On about March 18, 2010, at 428 Devener Street, Apt. # C, Riverside, CA 92507 California Department of Corrections (CDC) agents forcefully took copies of Coffelt's Work. Autodesk has a significant relationship with CDC. Evidence of this significant relationship will be provided to this Court.

107. In about the year 2011, at 1195 Spring Street, Apt. # C Riverside, CA 92507 CDC agents forcefully took copies of Coffelt's Work. Evidence of this unauthorized copy of Coffelt's copyrighted work will be provided to this Court.

108. In about the year 2013, at 14327 Frederick Street, Moreno Valley, CA 92553 CDC agents forcefully took copies of Coffelt's Work. Evidence of this unauthorized copy of Coffelt's copyrighted work will be provided to this Court.

109. For the above reasons, Autodesk attained access to Coffelt's copyrighted works on at least 3 occurrence, first in the year 2010, second about the year 2011, and third, about the year 2013.

110. Coffelt served the following individuals with a Cease and Desist letter directed to the copyright infringement issues in this action:

Autodesk Executives:

Andrew Anagnost, Carl Bass, Crawford W. Beveridge, Steve Blum, Chris Bradshaw,



1 Moonhie Chin, Pascal W. DiFronzo, Reid French, Thomas Georgens, R. Scott Herren,  
2 Richard S. Hill, Jeff Kowalski, Mary T. McDowell, Lorrie M. Norrington, Elizabeth Rafael,  
3 Stacy J. Smith, Eric Mitchel, Will Harris, Jorge Garcia, Edwin Robledo;  
4 GitHub individuals:

5 Alison Marcozzi, Chris Wanstrath (Corporate Executive Officer).

6 111. Larry Gritz is not authorized to copy or distribute Coffelt's copyrighted works.

7 Sony Imageworks is not authorized to copy or distribute Coffelt's copyrighted works.

8 Autodesk is not authorized to copy or distribute Coffelt's copyrighted works.

9 112. Coffelt has Not authorized any rights, in Coffelt's copyrighted works.

10 113. Coffelt has Not authorized any title, in Coffelt's copyrighted works.

11 114. Coffelt has Not authorized any interest, in Coffelt's copyrighted works.

12  
13 **FIRST CAUSE OF ACTION**

14 **(Copyright Infringement – 17 U.S.C. §501)**

15 115. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
16 1 through 114, inclusive.

17 116. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed  
18 works copied by Autodesk through various products including without limitation, AutoCad,  
19 Fusion 360, Maya, InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast.

20 117. For each of the claimed works in this matter, Plaintiff holds a copyright registration  
21 certificate from the United States Copyright Office.

22 118. Without authorization, Autodesk copied the following Plaintiff owned and copyrighted  
23 claimed work including:

24 (i) "Photorealistic Surface Shading by Reflective Intensity 2017", registration No. TX0008447381,

25 (ii) "Realistic 3D Surface Shading by Reflective Intensity 2010", Case No. 1-5121154211, or

26 (iii) "CAD Reflective Intensity" registration No. TXu002049564.

27 119. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright in  
28 the above identified Autodesk Products, in violation of Section 501 of the Copyright Act,

1 17 U.S.C. § 501(a).

2 120. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
3 and with indifference to Plaintiff's rights.

4 121. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
5 to damages of at least \$33,000,000 to be proven at trial.

6 122. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
7 17 U.S.C. § 504(b), including an accounting of such profits.

8 123. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
9 pursuant to 17 U.S.C. § 505 and otherwise according to law.

10 124. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
11 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
12 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
13 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
14 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
15 Defendants' continuing infringing conduct.

## 16 **SECOND CAUSE OF ACTION**

### 17 **(Copyright Infringement – Contributory Infringement)**

18 125. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
19 1 through 124, inclusive.

20 126. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed  
21 works distributed by Autodesk's products including without limitation, AutoCad, Fusion 360, Maya,  
22 InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast.

23 127. For each of the claimed works in this matter, Plaintiff holds a copyright registration  
24 certificate from the United States Copyright Office.

25 128. Without authorization, Autodesk adapted, including without limitation, AutoCad, Fusion  
26 360, Maya, InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast, to distribute the following  
27 Plaintiff owned and copyrighted claimed work including:

28 (i) "Photorealistic Surface Shading by Reflective Intensity 2017", registration No. TX0008447381,



1 (ii) "Realistic 3D Surface Shading by Reflective Intensity 2010", Case No. 1-5121154211, or

2 (iii) "CAD Reflective Intensity" registration No. TXu002049564.

3 129. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright  
4 by contributory infringement.

5 130. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
6 and with indifference to Plaintiff's rights.

7 131. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
8 to damages of at least \$33,000,000,000 to be proven at trial.

9 132. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
10 17 U.S.C. § 504(b), including an accounting of such profits.

11 133. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
12 pursuant to 17 U.S.C. § 505 and otherwise according to law.

13 134. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
14 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
15 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
16 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
17 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
18 Defendants' continuing infringing conduct.

### 19 **THIRD CAUSE OF ACTION**

#### 20 **(Copyright Infringement – Vicarious Liability)**

21 135. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
22 1 through 134, inclusive.

23 136. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed  
24 works distributed by Autodesk's products including without limitation, AutoCad, Fusion 360, Maya,  
25 InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast.

26 137. For each of the claimed works in this matter, Plaintiff holds a copyright registration  
27 certificate from the United States Copyright Office.

28 138. Without authorization, Autodesk adapted, including without limitation, AutoCad, Fusion

1 360, Maya, InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast, to distribute the following  
 2 Plaintiff owned and copyrighted claimed work including:

- 3 (i) "Photorealistic Surface Shading by Reflective Intensity 2017", registration No. TX0008447381,  
 4 (ii) "Realistic 3D Surface Shading by Reflective Intensity 2010", Case No. 1-5121154211, or  
 5 (iii) "CAD Reflective Intensity" registration No. TXu002049564.

6 139. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright  
 7 by vicarious liability.

8 140. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
 9 and with indifference to Plaintiff's rights.

10 141. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
 11 to damages of at least \$22,000,000,000 to be proven at trial.

12 142. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
 13 17 U.S.C. § 504(b), including an accounting of such profits.

14 143. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
 15 pursuant to 17 U.S.C. § 505 and otherwise according to law.

16 144. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
 17 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
 18 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
 19 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
 20 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
 21 Defendants' continuing infringing conduct.

#### 22 **FOURTH CAUSE OF ACTION**

##### 23 **(Copyright Infringement – Vicarious Liability)**

24 145. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
 25 1 through 144, inclusive.

26 146. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed  
 27 works distributed by Autodesk's products including without limitation, AutoCad, Fusion 360, Maya,  
 28 InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast.



1 147. For each of the claimed works in this matter, Plaintiff holds a copyright registration  
2 certificate from the United States Copyright Office.

3 148. Without authorization, Autodesk adapted, including without limitation, AutoCad, Fusion  
4 360, Maya, InfraWorks, AutoCAD Civil 3D, Revit, Inventor, or Beast, to distribute the following  
5 Plaintiff owned and copyrighted claimed work including:

6 (i) "Vector Plane Intersection" registration No. TXu002035517, or

7 (ii) "Steradian Space For Light Occlusion Derivation" registration No. TX0008356641.

8 149. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright  
9 by vicarious liability.

10 150. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
11 and with indifference to Plaintiff's rights.

12 151. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
13 to damages of at least \$11,000,000,000 to be proven at trial.

14 152. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
15 17 U.S.C. § 504(b), including an accounting of such profits.

16 153. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
17 pursuant to 17 U.S.C. § 505 and otherwise according to law.

18 154. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
19 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
20 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
21 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
22 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
23 Defendants' continuing infringing conduct.

## 24 **FIFTH CAUSE OF ACTION**

### 25 **(Copyright Infringement – 17 U.S.C. §501)**

26 155. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
27 1 through 154, inclusive.

28 156. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed

works distributed by Sony Imageworks through various products including without limitation, Open Source Shading Language (OSL).

157. For each of the claimed works in this matter, Plaintiff holds a copyright registration certificate from the United States Copyright Office.

158. Without authorization, Sony Imageworks distributed the following Plaintiff owned and copyrighted claimed work including:

- (i) "Photorealistic Surface Shading by Reflective Intensity 2017", registration No. TX0008447381,
- (ii) "Realistic 3D Surface Shading by Reflective Intensity 2010", Case No. 1-5121154211, or
- (iii) "CAD Reflective Intensity" registration No. TXu002049564.

159. Through their conduct averred herein, Sony Imageworks have infringed Plaintiffs' copyright in Open Source Shading Language (OSL), in violation of Section 501 of the Copyright Act, 17 U.S.C. § 501(a).

160. Sony Imageworks acts of infringement are willful, intentional and purposeful, in disregard of and with indifference to Plaintiff's rights.

## SIXTH CAUSE OF ACTION

### (Copyright Infringement —Vicarious Liability)

161. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs 1 through 160, inclusive.

162. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed works distributed by Autodesk's products including without limitation, AutoCad, Fusion 360, Maya, InfraWorks, AutoCAD Civil3D, Revit, Inventor, or Beast.

163. For each of the claimed works in this matter, Plaintiff holds a copyright registration certificate from the United States Copyright Office.

164. Without authorization, Autodesk adapted, including without limitation, AutoCad, Fusion 360, Maya, InfraWorks, AutoCAD Civil3D, Revit, Inventor, or Beast, to distribute the following Plaintiff owned and copyrighted claimed work including:

"emoshaGraphics CAD" Registration No. TX0008400276.

165. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright



1 by vicarious liability.

2 166. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
3 and with indifference to Plaintiff's rights.

4 167. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
5 to damages of at least \$33,000,000,000 to be proven at trial.

6 168. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
7 U.S.C. § 504(b), including an accounting of such profits.

8 169. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
9 pursuant to 17 U.S.C. § 505 and otherwise according to law.

10 170. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
11 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
12 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
13 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
14 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
15 Defendants' continuing infringing conduct.

## 16 SEVENTH CAUSE OF ACTION

### 17 (Copyright Infringement — Contributory Infringement)

18 171. Plaintiff repeats and incorporates by this reference the allegations set forth in paragraphs  
19 1 through 170, inclusive.

20 172. Plaintiff Coffelt is the author and sole owner of all rights title and interest of the claimed  
21 works distributed by Autodesk's products including without limitation, AutoCad, Fusion 360, Maya,  
22 InfraWorks, AutoCAD Civil3D, Revit, Inventor, or Beast.

23 173. For each of the claimed works in this matter, Plaintiff holds a copyright registration  
24 certificate from the United States Copyright Office.

25 174. Without authorization, Autodesk adapted, including without limitation, AutoCad, Fusion  
26 360, Maya, InfraWorks, AutoCAD Civil3D, Revit, Inventor, or Beast, to distribute the following  
27 Plaintiff owned and copyrighted claimed work including:

28 "emoshaGraphics CAD" Registration No. TX0008400276.

1 175. Through their conduct averred herein, Defendants have infringed Plaintiffs' copyright  
2 by contributory infringement.

3 176. Defendants' acts of infringement are willful, intentional and purposeful, in disregard of  
4 and with indifference to Plaintiff's rights.

5 177. As a direct and proximate result of said infringement by Defendants, Plaintiff is entitled  
6 to damages of at least \$33,000,000,000 to be proven at trial.

7 178. Plaintiff is also entitled to Defendant's profits attributable to the infringement, pursuant to  
8 U.S.C. § 504(b), including an accounting of such profits.

9 179. Plaintiff is further are entitled to Plaintiff's attorneys' fees and full costs  
10 pursuant to 17 U.S.C. § 505 and otherwise according to law.

11 180. As a direct and proximate result of the foregoing acts and conduct, Plaintiff has sustained  
12 and will continue to sustain substantial, immediate, and irreparable injury, for which there is no  
13 adequate remedy at law. Plaintiff is informed and believe and on that basis aver that unless enjoined  
14 and restrained by this Court, Defendants will continue to infringe Plaintiff's rights in the Infringed  
15 Works. Plaintiff is entitled to preliminary and permanent injunctive relief to restrain and enjoin  
16 Defendants' continuing infringing conduct.

### 17 **RELIEF**

18 181. WHEREFORE, Plaintiff request the following judgement against Defendant Autodesk  
19 as follows:

20 182. For Plaintiff's damages in the amount of \$ 33,000,000,000 (thirty three  
21 billion dollars) and any additional damages proven at trial; and Defendant's profits;

22 183. For preliminary and permanent injunction enjoining Defendant Autodesk  
23 and all persons acting in concert or participation with Autodesk from (a) directly or  
24 indirectly reproducing, distributing, or otherwise infringing in any manner on Plaintiff's  
25 copyrighted works.

26 184. For Plaintiff's attorneys' fees and full costs incurred in this action.

27 185. For any additional relief as this Court may deem just and proper.  
28

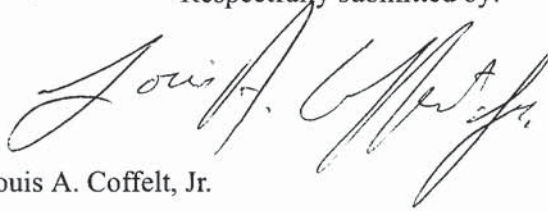


**DEMAND FOR JURY TRIAL**

Plaintiff, Louis A. Coffelt, Jr., hereby request a jury trial for all issues raised in this action.

Date: December 18, 2017

Respectfully submitted by:

A handwritten signature in cursive script, appearing to read "Louis A. Coffelt, Jr.", written in dark ink.

Louis A. Coffelt, Jr.

Plaintiff

Pro Se

# **APPENDIX**



# **EXHIBIT 100**

## Certificate of Registration



This Certificate issued under the seal of the Copyright Office in accordance with title 17, *United States Code*, attests that registration has been made for the work identified below. The information on this certificate has been made a part of the Copyright Office records.

*Karen Leigh Clayett*

Acting United States Register of Copyrights and Director

Registration Number

**TXu 2-035-517**

Effective Date of Registration:

December 14, 2016

### Title

Title of Work: Vector Plane Intersection

Title of Larger Work: emoshaGraphics CAD

### Completion/Publication

Year of Completion: 2013

### Author

- Author: Louis Arthur Coffelt  
Author Created: computer program  
Citizen of: United States  
Domiciled in: United States  
Year Born: 1959

### Copyright Claimant

Copyright Claimant: Louis Arthur Coffelt  
231 E. Alessandro Blvd., 6A-504, Riverside, CA, 92508, United States

### Rights and Permissions

Name: Louis Arthur Coffelt  
Email: louis.coffelt@gmail.com  
Telephone: (951)790-6086  
Address: 231 E. Alessandro Blvd., 6A-504  
Riverside, CA 92508 United States

### Certification

Name: Louis Arthur Coffelt, Jr.  
Date: December 14, 2016  
Applicant's Tracking Number: cad1122



```
void ImageAndPanelCls::IntersectijPlane(double &scrnxP, double &scrnyP, double ptxP, double ptyP, double ptzP,
double rptxP, double rptyP, double rptzP)
```

```
{
    si = ptxP - rptxP;
    sj = ptyP - rptyP;
    sk = ptzP - rptzP;
    i = abs(si);
    j = abs(sj);
    k = abs(sk);
    s0i = ptxP;
    s0j = ptyP;
    s0k = ptzP;
    if (i > 0.000000001)
    {
        mji = sj / si;
        mki = sk / si;
        tempi = (mki * s0i - s0k) / mki;
        tempj = mji * (tempi - s0i) + s0j;
    }
    else if (j > 0.000000001)
    {
        mij = si / sj;
        mkj = sk / sj;
        tempj = (mkj * s0j - s0k) / mkj;
        tempi = mij * (tempj - s0j) + s0i;
    }
    else if (k > 0.000000001)
    {
        mik = si / sk;
        mjk = sj / sk;
        tempi = mik * (-s0k) + s0i;
        tempj = mjk * (-s0k) + s0j;
    }
    scrnxP = tempi;
    scrnyP = tempj;
}
//
```

```
void ImageAndPanelCls::IntersectjkPlanePartialSolution(double &jP, double &kP, double rptxP, double rptyP, double
rptzP, double ptxP, double ptyP, double ptzP)
```

```
{
    si = rptxP - ptxP;
    sj = rptyP - ptyP;
    sk = rptzP - ptzP;
    //
    k = abs(sk);
    //
    s0i = ptxP;
    s0j = ptyP;
    s0k = ptzP;
    if (k > 0.000000001)
    {
        mik = si / sk;
        mjk = sj / sk;
```

TXU2-035-517

```

    tempk = (mik * s0k - s0i) / mik;
    tempj = mjk * (tempk - s0k) + s0j;
}
jP = tempj;
kP = tempk;
}
//
void ImageAndPanelCls::IntersectAnyPlanePartialSolution(double &ixintersectionP, double &jxintersectionP, double
&kxintersectionP, double N1iP, double N1jP, double N1kP, double N0iP, double N0jP, double N0kP, double ptxP,
double ptyP, double ptzP, double rptxP, double rptyP, double rptzP)
{
    N1ic = N1iP;
    N1jc = N1jP;
    N1kc = N1kP;
    N0ic = N0iP;
    N0jc = N0jP;
    N0kc = N0kP;
    Nic = N1ic - N0ic;
    Njc = N1jc - N0jc;
    Nkc = N1kc - N0kc;
    si = ptxP - rptxP;
    sj = ptyP - rptyP;
    sk = ptzP - rptzP;
    i = abs(si);
    j = abs(sj);
    k = abs(sk);
    s0i = ptxP;
    s0j = ptyP;
    s0k = ptzP;
    if (k > 0.000000001)
    {
        mik = si / sk;
        mjk = sj / sk;
        tempk = (mik * s0k * Nic - s0i * Nic + N0ic * Nic + mjk * s0k * Njc - s0j * Njc + N0jc * Njc + N0kc * Nkc) /
(mik * Nic + mjk * Njc + Nkc);
        tempi = mik * (tempk - s0k) + s0i;
        tempj = mjk * (tempk - s0k) + s0j;
    }
    ixintersectionP = tempi;
    jxintersectionP = tempj;
    kxintersectionP = tempk;
}
//

```



# **EXHIBIT 101**

C:\Documents and Settings\louis\My ... \VecPlnInt\ColorByReflectionVec.cs 1

```

using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
namespace VecPlnInt
{
    class ColorByReflectionVec
    {
        double ColorDouble = 0.0;
        int ColorInt = 0;
        //
        public void SetColorByReflectionVec(ref int RedComponentP, ref int GreenComponentP,
ref int BlueComponentP, ref int TotalChanges, double AdotBp1, int BaseColorRedP, int BaseColorGreenP,
int BaseColorBlueP)
        {
            // turquoise is approx 2f f2 f1
            // decreasing blue shifts towards green
            // decreasing green shifts towards royal blue (dark)
            // use 2 points of Reflection vector, and 2 points (view pt, surface pt)
            // vector, cos of angle between these two vectors to set color
            // if adotb < 0 : darken color
            // total shift is 3 red w/ 16 blue
            // 3 blue w/ 16 red
            // 3 green w/ 16 blue
            // 3 blue w/ 16 green
            // ShiftLimit1 = 255 - ShiftNum01;
            // ShiftLimit2 = 255 - ShiftNum02;
            // ShiftLimit3 = 255 - ShiftNum03;
            if (AdotBp1 > 0)
            {
                ColorDouble = 224 * AdotBp1;
                ColorInt = (int)ColorDouble;
                GreenComponentP = ColorInt;
            }
            else
            {
                GreenComponentP = 0;
            }
            RedComponentP = BaseColorGreenP;
            BlueComponentP = BaseColorBlueP;
            TotalChanges++;
        }
    }
}

```

Gradient Work 2010

Reproduction of original file

Modified / Original Created: Wednesday, October 20, 2010, 8:01:16 AM

**Coffelt's Gradient Work 2010**

U.S. Application No.: 1-5121154211, filed: May 13, 2017

Original Computer File Location: Coffelt's Laptop, Service Tag GMBTY32

File name: realistic\_3d\_surface\_shading\_by\_reflective\_intensity\_coffelt\_2010.pdf



# **EXHIBIT 102**

TX0008447381

```

//
//
//
//
0000  rflx = rptx - ptx00a;
0001  rfly = rpty - pty00a;
0002  rflz = rptz - ptz00a;
0003  lenrfl = sqrt(rflx * rflx + rfly * rfly + rflz * rflz);
0004  vpdotrfl = (vpax * rflx + vpay * rfly + vpaz * rflz) / (lenvpa * lenrfl);
0005  theta = acos(vpdotrfl);
0006  mgrad = -50 / (max_d - min_d);
0007  d0 = lenvpa * sin(theta);
0008  shift_d = mgrad * (d0 - min_d);
0009  blueD = 100.0;
0010  greenD = 255.0;
0011  redD = 100.0;
0012  blueD += shift_d;
0013  greenD += shift_d;
0014  redD += shift_d;
//
//
//
//
// Copyright 2017 by Louis A. Coffelt, Jr.
// TITLE OF THIS WORK: Photorealistic Surface Shading by Reflective Intensity 2017
// TYPE OF WORK: Computer Program
//
// This work is based on the Work by Louis A. Coffelt, Jr. created on
// Wednesday, October 20, 2010, 8:01:16 AM titled:
// ("Realistic 3D Surface Shading by Reflective Intensity 2010 ")
// Application Date: 5/13/2017.
// Service Request #: 1-5121154211
//
// This work is used in a larger work titled ("CAD Reflective Intensity")
// Application Date: December 13, 2016
// Service Request #: 1-4249380951
//
// The Claimed Work is the c++ program above at lines 0000 through 0014
// A description of this Claimed Work is the following:
//
//
//
//
// An objective of this claimed Work includes to derive photorealistic 3D surface
// shading for any type surface. A 3D graphic object is identified by a
// mathematical equation. There is a View Point in the 3D scene. There is a point
// light source in the 3D scene. Light source Incident Vectors intersect the
// graphic object. Light is reflected from the graphic object (Reflected Vector).
// The angle of incidence is equal to the reflected angle. The Reflected Vector and
// View Point are used to derive the light intensity for each corresponding point on
// the graphic object.
//
//
//
// lines 0000 through 0002 are the x, y, z, components of the Reflected Vector rfl.
// line 0003, lenrfl is the length of the Reflected Vector rfl.
// line 0004, vpa is the vector between the View Point and the graphic object point.
// line 0004, vpdotrfl is the vector dot product of vpa and rfl (cosine of angle).
// line 0005, theta is the angle between vectors vpa and rfl.
// line 0006, max_d is the maximum distance between the View Point and vector rfl.
// line 0006, min_d is the minimum distance between the View Point and vector rfl.
// line 0006, -50 is a selected constant for maximum shift of the base surface color.
// line 0006, mgrad is slope of a linear equation, which derives the color shift value.
// line 0007, d0 is current distance between the View Point and vector rfl.
// line 0008, shift_d is the value of the color shift from the base color value.
// lines 0009 through 0011, the base color of the graphic object surface is assigned.
// lines 0012 through 0014, the base color is shifted in order to create the
// photorealistic surface shading gradient.

```



# **EXHIBIT 103**

## Certificate of Registration



This Certificate issued under the seal of the Copyright Office in accordance with title 17, *United States Code*, attests that registration has been made for the work identified below. The information on this certificate has been made a part of the Copyright Office records.

*Karen Leigh Claywell*

Acting United States Register of Copyrights and Director

Registration Number

**TXu 2-049-564**

Effective Date of Registration:

December 13, 2016

### Title

Title of Work: CAD Reflective Intensity

Title of Larger Work: emoshaGraphics CAD

### Completion/Publication

Year of Completion: 2013

### Author

- Author: Louis Arthur Coffelt  
Author Created: computer program  
Citizen of: United States  
Domiciled in: United States  
Year Born: 1959

### Copyright Claimant

Copyright Claimant: Louis Arthur Coffelt  
231 E. Alessandro Blvd., 6A-504, Riverside, CA, 92508, United States

### Rights and Permissions

Name: Louis Arthur Coffelt  
Email: louis.coffelt@gmail.com  
Telephone: (951)790-6086  
Address: 231 E. Alessandro Blvd., 6A-504  
Riverside, CA 92508 United States

### Certification

Name: Louis Arthur Coffelt, Jr.  
Date: December 13, 2016  
Applicant's Tracking Number: cad1133



```
#include "StdAfx.h"
#include "Objects_Cls.h"
#include <cmath>
```

TXU002049564

```
void Objects_Cls::Sphere_____Steradians__(cli::array<double, 1>^ &StrDistV01p, cli::array<double, 1>^
&VisibleV01p, int systemNum01P, int numSurface01P, double t0p)
{
    __int64 SizeSTRv = StrDistV01p->Length;
    __int64 SizeVISv = VisibleV01p->Length;
    short int systemNum = systemNum01P;
    short int numSurface = numSurface01P;
    t0 = t0p;
    SetDynamicData(systemNum);
    double lampSphereR = 0.4;
    double mainSphereR = 0.5;
    double ptx00a = 0.0;
    double pty00a = 0.0;
    double ptz00a = 0.0;
    double ptx02a = 0.0;
    double pty02a = 0.0;
    double ptz02a = 0.0;
    int scrnindx = 0;
    int scrncolx = 0;
    int scrnrowx = 0;
    double scrncolxD = 0.0;
    double scrnrowxD = 0.0;
    double scrnxA = 0.0;
    double scrnyA = 0.0;
    double scrnC = 0.0;
    double scrnyC = 0.0;
    double cVisDistA = 0.0;
    double pVisDistA = 0.0;
    int StrIndxPxA = 0;
    double cStrDistA = 0.0;
    double pStrDistA = 0.0;
    //
    double d0 = 0.0;
    double N0000x = 0.0;
    double N0000y = 0.0;
    double N0000z = 0.0;
    double N0100x = 0.0;
    double N0100y = 0.0;
    double N0100z = 0.0;
    double N00x = 0.0;
    double N00y = 0.0;
    double N00z = 0.0;
    double N0002x = 0.0;
    double N0002y = 0.0;
    double N0002z = 0.0;
    double N0102x = 0.0;
    double N0102y = 1.0;
    double N0102z = 0.0;
    NextCoordinatesType3conversionOnly(N0000x, N0000y, N0000z, N0002x, N0002y, N0002z);
```

```

NextCoordinatesType3conversionOnly(N0100x, N0100y, N0100z, N0102x, N0102y, N0102z);
N00x = N0100x - N0000x;
N00y = N0100y - N0000y;
N00z = N0100z - N0000z;
double spax = 0.0;
double spay = 0.0;
double spaz = 0.0;
double spdx = 0.0;
double spdy = 0.0;
double spdz = 0.0;
double vpax = 0.0;
double vpay = 0.0;
double vpaz = 0.0;
double bx = 0.0;
double by = 0.0;
double bz = 0.0;
double cx = 0.0;
double cy = 0.0;
double cz = 0.0;
double spacos = 1.0;
double spasin = 1.0;
double dx = 0.0;
double dy = 0.0;
double dz = 0.0;
double ex = 0.0;
double ey = 0.0;
double ez = 0.0;
double rptx = 0.0;
double rpty = 0.0;
double rptz = 0.0;
double rflx = 0.0;
double rfly = 0.0;
double rflz = 0.0;
double spadotc = 1.0;
double vpdotrfl = 1.0;
double phi = 0.0;
double phix = 0.0;
double thetax = 0.0;
double theta = 0.0;
double c0 = 1.0;
double lenc = 1.0;
double lend = 1.0;
double lene = 1.0;
double lenspa = 1.0;
double lenvpa = 1.0;
double lenrfl = 1.0;
//
double pi = 3.1415926;
double twopi = 2.0 * pi;
double pid2 = pi / 2.0;
double threepid2 = 3.0 * pi / 2.0;
double pid6 = pi / 6.0;
double fivepid6 = 5.0 * pi / 6.0;
double sevenpid6 = 7.0 * pi / 6.0;

```



```

double elevenpid6 = 11.0 * pi / 6.0;
double r0 = 1.5;
double lenxy = 0.07;
double xz_limit = 0.0;
double m_s = 0.0;
double x = 0.0;
double y = 0.0;
double z = 0.0;
if (systemNum == 850 || systemNum == 851 || systemNum == 852 || systemNum == 853)
{
    dphi_c = dphi_850;
}
while (phix < twopi)
{
    thetax = theta_i;
    while (thetax < twopi)
    {
        pty02a = r_sphere_ui * cos(thetax);
        ptz02a = r_sphere_ui * sin(thetax) * sin(phix);
        ptx02a = r_sphere_ui * sin(thetax) * cos(phix);
        N0102x = ptx02a;
        N0102y = pty02a;
        N0102z = ptz02a;
        NextCoordinatesType3conversionOnly(N0100x, N0100y, N0100z, N0102x, N0102y, N0102z);
        N00x = N0100x - N0000x;
        N00y = N0100y - N0000y;
        N00z = N0100z - N0000z;
        NextCoordinatesType3(ptx00a, pty00a, ptz00a, scrnxA, scrnyA, ptx02a, pty02a, ptz02a);
        if (scrnxA > 0.0 && scrnxA < scrnWinches && scrnyA > 0.0 && scrnyA < scrnHInches)
        {
            scrncolxD = scrnxA * scrnppiD;
            scrnrowxD = scrnyA * scrnppiD;
            scrncolx = int(scrncolxD);
            scrnrowx = int(scrnrowxD);
            scrnindx = scrnrowx * scrnWpx + scrncolx;
            if (scrnindx < SizeVISv)
            {
                pVisDistA = VisibleV01p[scrnindx];
                cVisDistA = sqrt(si * si + sj * sj + sk * sk);
                if (cVisDistA < pVisDistA)
                {
                    VisibleV01p[scrnindx] = cVisDistA;
                    //
                    spax = spx - ptx00a;
                    spay = spy - pty00a;
                    spaz = spz - ptz00a;
                    lenspa = sqrt(spax * spax + spay * spay + spaz * spaz);
                    vpax = vpx - ptx00a;
                    vpay = vpy - pty00a;
                    vpaz = vpz - ptz00a;
                    lenvpa = sqrt(vpax * vpax + vpay * vpay + vpaz * vpaz);
                    bx = N00y * spaz - spay * N00z;
                    by = -(N00x * spaz - spax * N00z);
                    bz = N00x * spay - spax * N00y;
                }
            }
        }
    }
}

```

```

cx = N00y * bz - by * N00z;
cy = -(N00x * bz - bx * N00z);
cz = N00x * by - bx * N00y;
lenc = sqrt(cx * cx + cy * cy + cz * cz);
spadotc = (spax * cx + spay * cy + spaz * cz) / (lenspa * lenc);
phi = acos(spadotc);
spacos = lenspa * abs(cos(phi));
spasin = lenspa * sin(phi);
c0 = spacos / lenc;
ex = c0 * cx;
ey = c0 * cy;
ez = c0 * cz;
dx = ptx00a - ex;
dy = pty00a - ey;
dz = ptz00a - ez;
spdx = spx - dx;
spdy = spy - dy;
spdz = spz - dz;
rptx = ptx00a + ex + spdx;
rpty = pty00a + ey + spdy;
rptz = ptz00a + ez + spdz;
rflx = rptx - ptx00a;
rfly = rpty - pty00a;
rflz = rptz - ptz00a;
lenrfl = sqrt(rflx * rflx + rfly * rfly + rflz * rflz);
vpdotrfl = (vpax * rflx + vpay * rfly + vpaz * rflz) / (lenvpa * lenrfl);
theta = acos(vpdotrfl);
d0 = lenvpa * sin(theta);
if (systemNum == 850 && d0 < min_d_850)
{
    min_d_850 = d0;
}
if (systemNum == 850 && d0 > max_d_850)
{
    max_d_850 = d0;
}
if (systemNum == 851 && d0 < min_d_851)
{
    min_d_851 = d0;
}
if (systemNum == 851 && d0 > max_d_851)
{
    max_d_851 = d0;
}
if (systemNum == 852 && d0 < min_d_852)
{
    min_d_852 = d0;
}
if (systemNum == 852 && d0 > max_d_852)
{
    max_d_852 = d0;
}
if (systemNum == 853 && d0 < min_d_853)
{

```

```

        min_d_853 = d0;
    }
    if (systemNum == 853 && d0 > max_d_853)
    {
        max_d_853 = d0;
    }
    }
    }
    }
    thetax += dphi_c;
}
phix += dphi_c;
}
int stophere = 0;
}
//
void Objects_Cls::Sphere_____Iteration__(cli::array<System::Byte, 1>^ &RedVp, cli::array<System::Byte, 1>^ &GreenVp, cli::array<System::Byte, 1>^ &BlueVp, cli::array<double, 1>^ StrDistV00p, cli::array<double, 1>^ VisibleV00p, int systemNum00P, int numSurface00P, int numColor00P)
{
    __int64 sizeRedV = RedVp->Length;
    __int64 SizeSTRv = StrDistV00p->Length;
    __int64 SizeVISv = VisibleV00p->Length;
    int numColor = numColor00P;
    short int systemNum = systemNum00P;
    short int numSurface = numSurface00P;
    SetDynamicData(systemNum);
    double blueD = 180.0;
    double greenD = 180.0;
    double redD = 180.0;
    int btBlueInt = 180;
    int btGreenInt = 180;
    int btRedInt = 180;
    double shiftD = 0.0;
    double mgrad = -222.0 / 10.0;
    double ptx00b = 0.0;
    double pty00b = 0.0;
    double ptz00b = 0.0;
    double ptx02b = 0.0;
    double pty02b = 0.0;
    double ptz02b = 0.0;
    double spx00 = spx;
    double spy00 = spy;
    double spz00 = spz;
    double spx02 = 0.0;
    double spy02 = 0.0;
    double spz02 = 0.0;
    double vpx00 = vpx;
    double vpy00 = vpy;
    double vpz00 = vpz;
    double vpx02 = 0.0;
    double vpy02 = 0.0;
    double vpz02 = 0.0;
    int scrnindx = 0;

```



```

int scrncolx = 0;
int scrnrowx = 0;
double scrncolxD = 0.0;
double scrnrowxD = 0.0;
double scrnxB = 0.0;
double scrnyB = 0.0;
double cVisDistB = 0.0;
double pVisDistB = 0.0;
int StrIndxPxB = 0;
double cStrDistB = 0.0;
double pStrDistB = 0.0;
double scrnxD = 0.0;
double scrnyD = 0.0;
double cVisDistD = 0.0;
double pVisDistD = 0.0;
int StrIndxPxD = 0;
double cStrDistD = 0.0;
double pStrDistD = 0.0;
double deltaStr = 1.0;
double deltaVis = 1.0;
double pid3 = 3.1415926 / 3.0;
double d0 = 0.0;
double N0000x = 0.0;
double N0000y = 0.0;
double N0000z = 0.0;
double N0100x = 0.0;
double N0100y = 0.0;
double N0100z = 0.0;
double N00x = 0.0;
double N00y = 0.0;
double N00z = 0.0;
double N0002x = 0.0;
double N0002y = 0.0;
double N0002z = 0.0;
double N0102x = 0.0;
double N0102y = 1.0;
double N0102z = 0.0;
NextCoordinatesType3conversionOnly(N0000x, N0000y, N0000z, N0002x, N0002y, N0002z);
NextCoordinatesType3conversionOnly(N0100x, N0100y, N0100z, N0102x, N0102y, N0102z);
N00x = N0100x - N0000x;
N00y = N0100y - N0000y;
N00z = N0100z - N0000z;
double spax = 0.0;
double spay = 0.0;
double spaz = 0.0;
double spdx = 0.0;
double spdy = 0.0;
double spdz = 0.0;
double vpax = 0.0;
double vpay = 0.0;
double vpaz = 0.0;
double bx = 0.0;
double by = 0.0;
double bz = 0.0;

```

```

double cx = 0.0;
double cy = 0.0;
double cz = 0.0;
double spacos = 1.0;
double spasin = 1.0;
double dx = 0.0;
double dy = 0.0;
double dz = 0.0;
double ex = 0.0;
double ey = 0.0;
double ez = 0.0;
double rptx = 0.0;
double rpty = 0.0;
double rptz = 0.0;
double rflx = 0.0;
double rfly = 0.0;
double rflz = 0.0;
double spadotc = 1.0;
double vpdotrfl = 1.0;
double phi = 0.0;
double c0 = 1.0;
double lenc = 1.0;
double lend = 1.0;
double lene = 1.0;
double lenspa = 1.0;
double lenvpa = 1.0;
double lenrfl = 1.0;
int minRed = 1000;
int maxRed = 0;
double phix = 0.0;
double thetax = 0.0;
double theta = 0.0;
double pi = 3.1415926;
double twopi = 2.0 * pi;
double pid2 = pi / 2.0;
double threepid2 = 3.0 * pi / 2.0;
double pid6 = pi / 6.0;
double fivepid6 = 5.0 * pi / 6.0;
double sevenpid6 = 7.0 * pi / 6.0;
double elevenpid6 = 11.0 * pi / 6.0;
double r0 = 1.5;
double lenxy = 0.07;
double xz_limit = 0.0;
double m_s = 0.0;
double x = 0.0;
double y = 0.0;
double z = 0.0;
int countx = 0;
int county = 0;
System::String^ data = " ";
int maxr = 0;
int minr = 1000;
int maxg = 0;
int ming = 1000;

```

```

int maxb = 0;
int minb = 1000;
if (systemNum == 850)
{
    mgrad = -50 / (max_d_850 - min_d_850);
    dphi_c = dphi_850;
}
else if (systemNum == 851)
{
    mgrad = -50 / (max_d_851 - min_d_851);
    dphi_c = dphi_850;
}
if (systemNum == 852)
{
    mgrad = -50 / (max_d_852 - min_d_852);
    dphi_c = dphi_850;
}
else if (systemNum == 853)
{
    mgrad = -50 / (max_d_853 - min_d_853);
    dphi_c = dphi_850;
}
while (phix < twopi)
{
    thetax = theta_i;
    while (thetax < twopi)
    {
        pty02b = r_sphere_ui * cos(thetax);
        ptz02b = r_sphere_ui * sin(thetax) * sin(phix);
        ptx02b = r_sphere_ui * sin(thetax) * cos(phix);
        N0102x = ptx02b;
        N0102y = pty02b;
        N0102z = ptz02b;
        NextCoordinatesType3conversionOnly(N0100x, N0100y, N0100z, N0102x, N0102y, N0102z);
        N00x = N0100x - N0000x;
        N00y = N0100y - N0000y;
        N00z = N0100z - N0000z;
        NextCoordinatesType3(ptx00b, pty00b, ptz00b, scrnxB, scrnyB, ptx02b, pty02b, ptz02b);
        if (scrnxB > 0.0 && scrnxB < scrnWinches && scrnyB > 0.0 && scrnyB < scrnHInches)
        {
            scrncolxD = scrnxB * scrnppiD;
            scrnrowxD = scrnyB * scrnppiD;
            scrncolx = int(scrncolxD);
            scrnrowx = int(scrnrowxD);
            scrnindx = scrnrowx * scrnWpx + scrncolx;
            if (scrnindx < SizeVISv)
            {
                pVisDistB = VisibleV00p[scrnindx];
                cVisDistB = sqrt(si * si + sj * sj + sk * sk);
                deltaVis = abs(cVisDistB - pVisDistB);
                if (deltaVis < 0.001)
                {
                    spax = spx - ptx00b;

```



```

spay = spy - pty00b;
spaz = spz - ptz00b;
lenspa = sqrt(spax * spax + spay * spay + spaz * spaz);
vpax = vpx - ptx00b;
vpay = vpy - pty00b;
vpaz = vpz - ptz00b;
lenvpa = sqrt(vpax * vpax + vpay * vpay + vpaz * vpaz);
bx = N00y * spaz - spay * N00z;
by = -(N00x * spaz - spax * N00z);
bz = N00x * spay - spax * N00y;
cx = N00y * bz - by * N00z;
cy = -(N00x * bz - bx * N00z);
cz = N00x * by - bx * N00y;
lenc = sqrt(cx * cx + cy * cy + cz * cz);
spadotc = (spax * cx + spay * cy + spaz * cz) / (lenspa * lenc);
phi = acos(spadotc);
spacos = lenspa * abs(cos(phi));
spasin = lenspa * sin(phi);
c0 = spacos / lenc;
ex = c0 * cx;
ey = c0 * cy;
ez = c0 * cz;
dx = ptx00b - ex;
dy = pty00b - ey;
dz = ptz00b - ez;
spdx = spx - dx;
spdy = spy - dy;
spdz = spz - dz;
rptx = ptx00b + ex + spdx;
rpty = pty00b + ey + spdy;
rptz = ptz00b + ez + spdz;
rflx = rptx - ptx00b;
rfly = rpty - pty00b;
rflz = rptz - ptz00b;
lenrfl = sqrt(rflx * rflx + rfly * rfly + rflz * rflz);
vpdotrfl = (vpax * rflx + vpay * rfly + vpaz * rflz) / (lenvpa * lenrfl);
theta = acos(vpdotrfl);
d0 = lenvpa * sin(theta);
if (systemNum == 850)
{
    shiftd = mgrad * (d0 - min_d_850);
}
if (systemNum == 851)
{
    shiftd = mgrad * (d0 - min_d_851);
}
if (systemNum == 852)
{
    shiftd = mgrad * (d0 - min_d_852);
}
if (systemNum == 853)
{
    shiftd = mgrad * (d0 - min_d_853);
}

```

```

        blueD = 55.0;
        greenD = 255.0;
        redD = 55.0;
        blueD += shiftD;
        greenD += shiftD;
        redD += shiftD;
        btBlueInt = int(blueD);
        btGreenInt = int(greenD);
        btRedInt = int(redD);
        countx++;
        if (btBlueInt > 255)
        {
            btBlueInt = 255;
        }
        if (btBlueInt < 0)
        {
            btBlueInt = 0;
        }
        if (btGreenInt > 255)
        {
            btGreenInt = 255;
        }
        if (btGreenInt < 0)
        {
            btGreenInt = 0;
        }
        if (btRedInt > 255)
        {
            btRedInt = 255;
        }
        if (btRedInt < 0)
        {
            btRedInt = 0;
        }
        btBlue = System::Byte(btBlueInt);
        btGreen = System::Byte(btGreenInt);
        btRed = System::Byte(btRedInt);
        countx++;
        RedVp[scrnindx] = btRed;
        GreenVp[scrnindx] = btGreen;
        BlueVp[scrnindx] = btBlue;
    }
}
    }
    thetax += dphi_c;
}
    phix += dphi_c;
}
//
    int stophere = 0;
}
//
void Objects_Cls::NextCoordinatesType3(double &ptx33P, double &pty33P, double &ptz33P, double &scrnx33P,
double &scrny33P, double ptx33p, double pty33p, double ptz33p)

```

```

{
    ptm03 = ptx33p;
    ptn03 = pty33p;
    pto03 = ptz33p;
    ptd03 = ptm03;
    pte03 = ptn03 * ne03 + pto03 * oe03;
    ptf03 = ptn03 * nf03 + pto03 * of03;
    pti03 = ptd03 * di03 + ptf03 * fi03;
    ptj03 = pte03;
    ptk03 = ptd03 * dk03 + ptf03 * fk03;
    ptx03 = pti03 * ix03 + ptj03 * jx03;
    pty03 = pti03 * iy03 + ptj03 * jy03;
    ptz03 = ptk03;
    ptm02 = ptx03 + T03x;
    ptn02 = pty03 + T03y;
    pto02 = ptz03 + T03z;
    ptd02 = ptm02;
    pte02 = ptn02 * ne02 + pto02 * oe02;
    ptf02 = ptn02 * nf02 + pto02 * of02;
    pti02 = ptd02 * di02 + ptf02 * fi02;
    ptj02 = pte02;
    ptk02 = ptd02 * dk02 + ptf02 * fk02;
    ptx02 = pti02 * ix02 + ptj02 * jx02;
    pty02 = pti02 * iy02 + ptj02 * jy02;
    ptz02 = ptk02;
    ptm01 = ptx02 + T02x;
    ptn01 = pty02 + T02y;
    pto01 = ptz02 + T02z;
    ptd01 = ptm01;
    pte01 = ptn01 * ne01 + pto01 * oe01;
    ptf01 = ptn01 * nf01 + pto01 * of01;
    pti01 = ptd01 * di01 + ptf01 * fi01;
    ptj01 = pte01;
    ptk01 = ptd01 * dk01 + ptf01 * fk01;
    ptx01 = pti01 * ix01 + ptj01 * jx01;
    pty01 = pti01 * iy01 + ptj01 * jy01;
    ptz01 = ptk01;
    ptm00 = ptx01 + T01x;
    ptn00 = pty01 + T01y;
    pto00 = ptz01 + T01z;
    ptd00 = ptm00;
    pte00 = ptn00 * ne00 + pto00 * oe00;
    ptf00 = ptn00 * nf00 + pto00 * of00;
    pti00 = ptd00 * di00 + ptf00 * fi00;
    ptj00 = pte00;
    ptk00 = ptd00 * dk00 + ptf00 * fk00;
    ptx00 = pti00 * ix00 + ptj00 * jx00;
    pty00 = pti00 * iy00 + ptj00 * jy00;
    ptz00 = ptk00;
    ptx00 += Tcgx;
    pty00 += Tcgy;
    ptz00 += Tcgz;
    si = ptx00 - vpx;
    sj = pty00 - vpy;

```



```

sk = ptz00 - vpz;
i = abs(si);
j = abs(sj);
k = abs(sk);
s0i = ptx00;
s0j = pty00;
s0k = ptz00;
if (i > 0.000000001)
{
    mji = sj / si;
    mki = sk / si;
    tempi = (mki * s0i - s0k) / mki;
    tempj = mji * (tempi - s0i) + s0j;
}
else if (j > 0.000000001)
{
    mij = si / sj;
    mkj = sk / sj;
    tempj = (mkj * s0j - s0k) / mkj;
    tempi = mij * (tempj - s0j) + s0i;
}
else if (k > 0.000000001)
{
    mik = si / sk;
    mjk = sj / sk;
    tempi = mik * (-s0k) + s0i;
    tempj = mjk * (-s0k) + s0j;
}
ptx33P = ptx00;
pty33P = pty00;
ptz33P = ptz00;
scrnx33P = tempi;
scrny33P = tempj;
}
//
void Objects_Cls::IntersectScreen(double &scrnxP, double &scrnyP, double ptxP, double ptyP, double ptzP)
{
    si = ptxP - vpx;
    sj = ptyP - vpy;
    sk = ptzP - vpz;
    i = abs(si);
    j = abs(sj);
    k = abs(sk);
    s0i = ptxP;
    s0j = ptyP;
    s0k = ptzP;
    if (i > 0.000000001)
    {
        mji = sj / si;
        mki = sk / si;
        tempi = (mki * s0i - s0k) / mki;
        tempj = mji * (tempi - s0i) + s0j;
    }
    else if (j > 0.000000001)

```

```
{
    mij = si / sj;
    mkj = sk / sj;
    tempj = (mkj * s0j - s0k) / mkj;
    tempi = mij * (tempj - s0j) + s0i;
}
else if (k > 0.000000001)
{
    mik = si / sk;
    mjk = sj / sk;
    tempi = mik * (-s0k) + s0i;
    tempj = mjk * (-s0k) + s0j;
}
scrnxP = tempi;
scrnyP = tempj;
}
//
```

# **EXHIBIT 104**



## Certificate of Registration



This Certificate issued under the seal of the Copyright Office in accordance with title 17, *United States Code*, attests that registration has been made for the work identified below. The information on this certificate has been made a part of the Copyright Office records.

*Karen Leigh Claywell*

Acting United States Register of Copyrights and Director

Registration Number

**TX 8-356-641**

Effective Date of Registration:  
December 15, 2016

### Title

Title of Work: Steradian Space For Light Occlusion Derivation  
Title of Larger Work: emoshaGraphics CAD

### Completion/Publication

Year of Completion: 2011  
Date of 1st Publication: March 14, 2016  
Nation of 1st Publication: United States

### Author

- Author: Louis Arthur Coffelt  
Author Created: computer program  
Citizen of: United States  
Domiciled in: United States  
Year Born: 1959

### Copyright Claimant

Copyright Claimant: Louis Arthur Coffelt  
231 E. Alessandro Blvd., 6A-504, Riverside, CA, 92508, United States

### Rights and Permissions

Name: Louis Arthur Coffelt  
Email: louis.coffelt@gmail.com  
Telephone: (951)790-6086  
Address: 231 E. Alessandro Blvd., 6A-504  
Riverside, CA 92508 United States

### Certification

Name: Louis Arthur Coffelt, Jr.  
Date: December 15, 2016

TX 8-356-641

```
// SteradiansXame.h
#include <cmath>
#pragma once
using namespace System;
namespace SteradiansXame {
    public ref class SteradianCls
    {
    public:
        static void SetSteradians(double &cmin00p, double &cmax00p, double &rmin00p, double &rmax00p, double
        &strRadius00p, double &strPpiD00p, int &strColWpx00p, int &totalStrPx00p, double spx00p, double spy00p, double
        spz00p, double Tcgx00p, double Tcgy00p, double Tcgz00p)
        {
            double StrPpiD = 125.0;
            double lenArcCol = 20.0;
            double lenArcRow = 20.0;
            double StrColWpxD = lenArcCol * StrPpiD;
            double StrRowHpxD = lenArcRow * StrPpiD;
            int StrColWpx = int(StrColWpxD);
            int StrRowHpx = int(StrRowHpxD);
            int totalStrPx = StrRowHpx * StrColWpx;
            double StrRadiusOffset = 4.0;
            double cgspx = Tcgx00p - spx00p;
            double cgspy = Tcgy00p - spy00p;
            double cgspz = Tcgz00p - spz00p;
            double lencgsp = sqrt(cgspx * cgspx + cgspy * cgspy + cgspz * cgspz);
            double strRadius = sqrt(cgspx * cgspx + cgspy * cgspy + cgspz * cgspz) + StrRadiusOffset;
            double totalColAngle = lenArcCol / strRadius;
            double totalRowAngle = lenArcRow / strRadius;
            double lenCgSpxy = sqrt(cgspx * cgspx + cgspy * cgspy);
            double absCgSpy = abs(cgspy);
            double cgspxydotx = cgspx / lenCgSpxy;
            double centerStrCol = acos(cgspxydotx) * cgspy / absCgSpy;
            double columnAngle = 0.5 * totalColAngle;
            double cmax = centerStrCol + columnAngle;
            double cmin = centerStrCol - columnAngle;
            double cgspdotz = cgspz / lencgsp;
            double centerStrRow = acos(cgspdotz);
            double rowAngle = 0.5 * totalRowAngle;
            double rmax = centerStrRow + rowAngle;
            double rmin = centerStrRow - rowAngle;
            cmin00p = cmin;
            cmax00p = cmax;
            rmin00p = rmin;
            rmax00p = rmax;
            strRadius00p = strRadius;
            strPpiD00p = StrPpiD;
            strColWpx00p = StrColWpx;
            totalStrPx00p = totalStrPx;
        }
    };
}
```

```

void ImageAndPanelCls::NextSteradian(int &strIndxP, double &cStrDistP, double pt00xP, double pt00yP, double
pt00zP)
{
    ptx00c = pt00xP;
    pty00c = pt00yP;
    ptz00c = pt00zP;
    ptspcx = ptx00c - spcx;
    ptspcy = pty00c - spcy;
    ptspcz = ptz00c - spcz;
    cStrDist = sqrt(ptspcx * ptspcx + ptspcy * ptspcy + ptspcz * ptspcz);
    lenptspcx = sqrt(ptspcx * ptspcx + ptspcy * ptspcy);
    absPtSpy = abs(ptspcy);
    if(absPtSpy < 0.0000000001)
    {
        absPtSpy = 0.0000000001;
    }
    ptspcydotx = ptspcx / lenptspcx;
    StrColAngle = acos(ptspcydotx) * ptspcy / absPtSpy;
    ptspdotz = ptspcz / cStrDist;
    StrRowAngle = acos(ptspdotz);
    if (StrColAngle > cmin && StrColAngle < cmax && StrRowAngle > rmin && StrRowAngle < rmax)
    {
        StrColAngle -= cmin;
        StrRowAngle -= rmin;
    }
    lenArcCol = abs(strRadius * StrColAngle);
    lenArcRow = abs(strRadius * StrRowAngle);
    StrColIndxD = lenArcCol * StrRppiD;
    StrRowIndxD = lenArcRow * StrRppiD;
    StrColIndx = int(StrColIndxD);
    StrRowIndx = int(StrRowIndxD);
    StrIndxPx = StrRowIndx * StrColWpx + StrColIndx;
    strIndxP = StrIndxPx;
    cStrDistP = cStrDist;
}
//

```



# **EXHIBIT 105**

## Certificate of Registration



This Certificate issued under the seal of the Copyright Office in accordance with title 17, *United States Code*, attests that registration has been made for the work identified below. The information on this certificate has been made a part of the Copyright Office records.

*Karen Leigh Clayett*

Acting United States Register of Copyrights and Director

Registration Number

**TXu 2-037-997**

Effective Date of Registration:  
December 28, 2016

### Title

Title of Work: emoshaGraphics CAD alpha

Title of Larger Work: emoshaGraphics CAD

### Completion/Publication

Year of Completion: 2016

### Author

- Author: Louis Arthur Coffelt  
Author Created: computer program  
Citizen of: United States  
Domiciled in: United States  
Year Born: 1959

### Copyright Claimant

Copyright Claimant: Louis Arthur Coffelt  
231 E. Alessandro Blvd., 6A-504, Riverside, CA, 92508, United States

### Rights and Permissions

Name: Louis Arthur Coffelt  
Email: louis.coffelt@gmail.com  
Telephone: (951)790-6086

### Certification

Name: Louis Arthur Coffelt, Jr.  
Date: December 28, 2016  
Applicant's Tracking Number: egcad1133

```

#pragma once
#include "C:\\test\\cad_dll\\Convert_Binary_To_Doubles.h"
#include "C:\\test\\cad_dll\\WriteBinaryDoublesOrIntDLL.h"
#include "C:\\test\\cad_dll\\Convert_Doubles_To_Binary.h"
#include "Drawing_Cls.h"

namespace CppWinForm1
{
    using namespace System;
    using namespace System::ComponentModel;
    using namespace System::Collections;
    using namespace System::Windows::Forms;
    using namespace System::IO;
    using namespace System::Data;
    using namespace System::Drawing;
    using namespace Convert_Binary_To_Doubles;
    using namespace WriteBinaryDoublesDLLx;
    using namespace Convert_Doubles_To_Binary;
    /// <summary>
    /// Summary for MyForm
    /// </summary>
    public ref class MyForm : public System::Windows::Forms::Form
    {
    public:
        MyForm(void)
        {
            InitializeComponent();
            //
            //TODO: Add the constructor code here
            //
        }

    protected:
        /// <summary>
        /// Clean up any resources being used.
        /// </summary>
        ~MyForm()
        {
            if (components)
            {
                delete components;
            }
        }

    private: System::Windows::Forms::PictureBox^ fileButton;
    private: System::Windows::Forms::PictureBox^ newOpenCloseSaveButton;

    protected:

    protected:

    private:
        /// <summary>
        /// Required designer variable.
        /// </summary>
        System::ComponentModel::Container ^components;
    private: System::Windows::Forms::PictureBox^ viewButton;
    private: System::Windows::Forms::PictureBox^ rotateZoomButton;

    private: System::Windows::Forms::PictureBox^ planeButton;

```

TXu 2-037-997



```

private: System::Windows::Forms::DataGridViewTextBoxColumn^ surface_type;
private: System::Windows::Forms::DataGridViewTextBoxColumn^ Column6;
private: System::Windows::Forms::DataGridViewTextBoxColumn^ Column7;
private: System::Windows::Forms::PictureBox^ cancelSurfaceButton;
private: System::Windows::Forms::PictureBox^ newProjectButton;
private: System::Windows::Forms::Label^ recentFileName1button;
private: System::Windows::Forms::Label^ recentFileName2button;
private: System::Windows::Forms::Label^ recentFileName3button;

```

```

private: System::Windows::Forms::DataGridView^ surfaceListBox;

```

```

#pragma region Windows Form Designer generated code

```

```

/// <summary>
/// Required method for Designer support - do not modify
/// the contents of this method with the code editor.
/// </summary>

```

```

void InitializeComponent(void)
{

```

```

    System::ComponentModel::ComponentResourceManager^ resources = (gcnew
System::ComponentModel::ComponentResourceManager(MyForm::typeid));
    System::Windows::Forms::DataGridViewCellStyle^ dataGridViewCellStyle7 = (gcnew
System::Windows::Forms::DataGridViewCellStyle());
    System::Windows::Forms::DataGridViewCellStyle^ dataGridViewCellStyle8 = (gcnew
System::Windows::Forms::DataGridViewCellStyle());
    System::Windows::Forms::DataGridViewCellStyle^ dataGridViewCellStyle9 = (gcnew
System::Windows::Forms::DataGridViewCellStyle());
    this->fileButton = (gcnew System::Windows::Forms::PictureBox());
    this->newOpenCloseSaveButton = (gcnew System::Windows::Forms::PictureBox());
    this->viewButton = (gcnew System::Windows::Forms::PictureBox());
    this->rotateZoomButton = (gcnew System::Windows::Forms::PictureBox());
    this->planeButton = (gcnew System::Windows::Forms::PictureBox());
    this->triangleButton = (gcnew System::Windows::Forms::PictureBox());
    this->discButton = (gcnew System::Windows::Forms::PictureBox());
    this->ringButton = (gcnew System::Windows::Forms::PictureBox());
    this->cylinderButton = (gcnew System::Windows::Forms::PictureBox());
    this->sphereButton = (gcnew System::Windows::Forms::PictureBox());
    this->hemisphereButton = (gcnew System::Windows::Forms::PictureBox());
    this->helpButton = (gcnew System::Windows::Forms::PictureBox());
    this->outputImage = (gcnew System::Windows::Forms::PictureBox());
    this->selectedSurfaceColor = (gcnew System::Windows::Forms::PictureBox());
    this->deleteSurfaceButton = (gcnew System::Windows::Forms::PictureBox());
    this->editSurfaceButton = (gcnew System::Windows::Forms::PictureBox());
    this->surfaceListBox = (gcnew System::Windows::Forms::DataGridView());
    this->surface_type = (gcnew System::Windows::Forms::DataGridViewTextBoxColumn());
    this->Column6 = (gcnew System::Windows::Forms::DataGridViewTextBoxColumn());
    this->Column7 = (gcnew System::Windows::Forms::DataGridViewTextBoxColumn());
    this->colorPaletteImage = (gcnew System::Windows::Forms::PictureBox());
    this->xpobox = (gcnew System::Windows::Forms::TextBox());
    this->ypobox = (gcnew System::Windows::Forms::TextBox());
    this->zpobox = (gcnew System::Windows::Forms::TextBox());

```

```

private: System::Windows::Forms::PictureBox^ triangleButton;
private: System::Windows::Forms::PictureBox^ discButton;
private: System::Windows::Forms::PictureBox^ ringButton;

private: System::Windows::Forms::PictureBox^ cylinderButton;

private: System::Windows::Forms::PictureBox^ sphereButton;
private: System::Windows::Forms::PictureBox^ hemisphereButton;


private: System::Windows::Forms::PictureBox^ helpButton;
private: System::Windows::Forms::PictureBox^ outputImage;


private: System::Windows::Forms::PictureBox^ selectedSurfaceColor;
private: System::Windows::Forms::PictureBox^ deleteSurfaceButton;
private: System::Windows::Forms::PictureBox^ editSurfaceButton;
private: System::Windows::Forms::PictureBox^ colorPalletImage;
private: System::Windows::Forms::TextBox^ xp0box;
private: System::Windows::Forms::TextBox^ yp0box;
private: System::Windows::Forms::TextBox^ zp0box;
private: System::Windows::Forms::TextBox^ zp1box;
private: System::Windows::Forms::TextBox^ yp1box;
private: System::Windows::Forms::TextBox^ xp1box;
private: System::Windows::Forms::TextBox^ radiusBox;


private: System::Windows::Forms::PictureBox^ newSurfaceButton;
private: System::Windows::Forms::PictureBox^ saveSurfaceButton;
private: System::Windows::Forms::TextBox^ surfaceDescriptionBox;
private: System::Windows::Forms::PictureBox^ saveDescriptionButton;


private: System::Windows::Forms::PictureBox^ button188x32;


private: System::Windows::Forms::Label^ SelectedColorTipLabel;
private: System::Windows::Forms::Label^ recentFileName0button;


private: System::Windows::Forms::TextBox^ zp2box;
private: System::Windows::Forms::TextBox^ yp2box;
private: System::Windows::Forms::TextBox^ xp2box;
private: System::Windows::Forms::TextBox^ zp3box;
private: System::Windows::Forms::TextBox^ yp3box;
private: System::Windows::Forms::TextBox^ xp3box;
private: System::Windows::Forms::PictureBox^ lineButton;
private: System::Windows::Forms::PictureBox^ filletLinearButton;
private: System::Windows::Forms::PictureBox^ surfaceDensityButton;
private: System::Windows::Forms::PictureBox^ lightSourceButton;
private: System::Windows::Forms::TextBox^ doubleInput2box;
private: System::Windows::Forms::TextBox^ doubleInput1box;
private: System::Windows::Forms::TextBox^ doubleInput0box;
private: System::Windows::Forms::PictureBox^ saveDoublesButton;
private: System::Windows::Forms::Label^ double0Label;
private: System::Windows::Forms::Label^ double1Label;
private: System::Windows::Forms::Label^ double2Label;
private: System::Windows::Forms::PictureBox^ cancelInputButton;


private: System::Windows::Forms::PictureBox^ densityChoiceButton;
private: System::Windows::Forms::Label^ densityValueLabel;
private: System::Windows::Forms::PictureBox^ startPageButton;
private: System::Windows::Forms::PictureBox^ start_page_dwg_ico;

```

# **EXHIBIT 106**